THE

MEDICAL STUDENT'S VADE MECUM.

A COMPENDIUM OF

ANATOMY, PHYSIOLOGY, CHEMISTRY, POISONS, MATERIA MEDICA, PHARMACY, SURGERY, OBSTETRICS, PRACTICE OF MEDICINE, DISEASES OF THE SKIN, Etc. Etc.

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PREFACE TO THE FIFTH EDITION.

In presenting the fifth edition of this compend to Medical Students, the only apology which it is necessary to offer is the rapid sale of the four former ones; and this has been considered as sufficient evidence that the work has proved useful.

The careful revision which the present edition has undergone, makes the work more complete, and gives it, the author trusts, higher claims to a favorable reception.

The object is to furnish the Student of Medicine with a short and succinct view of the most important facts and principles which engage his attention during his pupilage, in order that he may refresh and fix more firmly upon his memory what he has read and heard, as well as to enable him properly to arrange his knowledge so as to use it in the most advantageous manner.

With such a Vade Mecum many leisure moments may be rescued from entire loss, whether occurring in the class-room, before or between lectures, while in attendance at the hospital, or elsewhere, and turned to good account. These short intervals of time, when singly considered, may seem of little value; but, taken in the aggregate, and usefully employed, may be of great consequence.

It is also believed that the present edition will be found useful as a Pocket Manual to the young Practitioner, serving to refresh his memory on elementary subjects, and on practical points, in cases of emergency. By reference to it, he will be able to bring before his mind the principal points of subjects (perhaps partially forgotten), that may be important and useful, under circumstances not permitting a reference to more voluminous and extensive works.

These we consider to be the legitimate objects of all works of this description, and, when used as intended, they cannot but be of great practical advantage.

No claim is made to originality; it is strictly a compilation from standard authorities, intended to present, in a brief space and compact form, the outlines of generally admitted truths of Medicine. We have, therefore, drawn freely from the best sources within our reach, and copied ideas — and in some cases the words — of the different authors that have been used. This general acknowledgment is due, although a reference to the particular works may be unnecessary.

CINCINNATI, *September*, 1857.

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THE

MEDICAL STUDENT'S

VADE MECUM.

PART I.—ANATOMY.

Q. What is Anatomy? A. The science of organization.

How is it divided? Into *Vegetable* and *Animal.*

How is Animal Anatomy divided? Into *Human* and *Comparative.*

What is Human Anatomy? The Anatomy of man.

What is Comparative Anatomy? The Anatomy of all other animals except man.

How is human anatomy divided? Into *Descriptive*, or *Special*, *Surgical*, *General*, and *Pathological.*

What is Descriptive, or Special Anatomy? That which describes the form, size, position, and connections of organs in a healthy condition of the body.

What is Surgical Anatomy? That which treats of the relation of one part to another, and has also been termed *Regional Anatomy.*

What is General Anatomy? That which treats of the structure of the simple tissues of the body; and is synonymous with Histology.

What is Pathological Anatomy? That which relates to the diseased structure of the organs.

Under what divisions is human anatomy studied? *Osteology*, or a description of the bones. *Syndesmology*, of the ligaments. *Myology*, of the muscles. *Splanchnology*, of the viscera. *Adenology*, of the glands. *Angiology*, of the vessels. *Neurology*, of the nerves. *Dermology*, of the skin.

What are the *ultimate elements* of the body? *Carbon, nitro-*

gen, oxygen, hydrogen, phosphorus, sulphur, iron, calcium, sodium, potassium, &c.

What are the organic elements? *Gelatin, fibrin, albumen, mucus, fat,* &c.

SKELETON.

What are the organs of support to the animal frame? The *bones;* they give firmness and strength to the body, afford points of attachment for the numerous muscles, give shape to the animal, and afford protection to some of the more important organs; such as the encephalon, medulla spinalis, heart, lungs, &c. Their form and disposition are always adapted to the offices they are designed to fulfil.

What is the bony framework of the human body called? *Skeleton.*

What is the *natural* skeleton? When the bones are held together by their natural connections of ligaments, cartilages, &c.

What is an *artificial* skeleton? When the bones are held together by artificial means.

Suppose a line, called the median, drawn from the top of the head, downward through the middle of the skeleton, will these two sides be similar? Yes, the bones of the two sides will be perfectly alike: and where bones are divided, the two halves will be symmetrical.

What are the regional divisions of the skeleton? *Head, Trunk, Superior,* and *Inferior extremities.*

What is the number of bones in persons of middle age? For the *trunk*—twenty-four true vertebræ, one sacrum, four coccygeal, two innominata, twelve ribs on each side, and one sternum. For the *head*—eight in the cranium, fourteen for the face, and one hyoid. For the *upper extremities*—thirty-four to each side. For the *inferior extremities*—thirty-two to each side. In all, two hundred and eleven, not including the bones of the tympanum and teeth. In early life the number is greater, and in old age diminished, by the growing together of bones originally distinct.

How are bones divided in regard to their *shape*? Into *long, short, flat,* and *irregular.* The *long* bones are found principally in the limbs, and are composed of a shaft and two extremities. Short bones are irregularly cuboidal in form, spongy in texture internally,

with a thin crust externally. The *short* bones are the vertebræ, coccyx, carpal and tarsal bones, patellæ and sesamoid bones. *Flat* bones consist of two layers of dense bone with an intermediate cellular structure, which is called diploe. *Irregular* bones are those which are not distinctly referable to either of the above divisions; but are of a mixed character, being partly short and partly flat. The temporal, sphenoid, ethmoid, superior maxillary, inferior maxillary, palate, inferior turbinated bones, os hyoides, and sacrum present examples of this class.

What is an *eminence* on a bone called? *Apophysis* or *process* when united, and *epiphysis* when separated by cartilage; the shaft or body of a bone is termed its *diaphysis*.

What other names are applied to eminences of bone depending upon their shape, situation, and use? *Heads*, when convex, roundish, and smooth. *Necks*, when smaller at the middle, and increased towards the extremity. *Condyles*, when the head is large and unequally rounded. *Tubercles*, or *tuberosities*, when uneven, rough, and irregular. *Spines* or *spinous processes*, when sharp or pointed. *Cristæ*, when there are long and sharp elevations. *Coronoid*, if the termination is in a sharp edge. *Mastoid*, *styloid*, *coracoid*, &c., from their resemblance to certain other things. *Oblique transverse*, &c., from relative situations. *Trochanters*, when they serve to turn a bone.

What names are given to *depressions?* *Cotyloid*, when deep and cup-like. *Alveoli*, or sockets, as the sockets for the teeth; and, *glenoid*, when superficial.

How are bones divided in regard to *density?* Into *compact* and *cellular;* the former is situated externally, and the latter internally.

What is the *composition* of bones? *Animal* and *earthy* matter. The minute analysis of which is gelatin, 32 parts; phosphate of lime, 51 parts; carbonate of lime, 11 parts; fluate of lime, 2 parts; phosphate of magnesia, 1 part; and muriate of soda, 1 part. The bones also contain a little iron, manganese, silex, alumina, and phosphate of ammonia.

Upon which of these primary constituents does the hardness of the bone depend? The earthy, and may be obtained by calcination.

How may the animal part be demonstrated? By immersion for some time in dilute muriatic acid, the earthy parts will be dissolved, leaving the animal.

What is the *structure* of bones? They are composed of two structures, *compact* and *cellular;* the former is situated externally, and the latter internally. The compact structure is fibrous, but arranged in lamina. Running through these fibres we have the *Haversian canals*, which communicate with small lenticular excavations known as the *lacunæ* or *corpuscles* of *Purkinjé*, by pores or tubuli, which also connect these lacunæ together. They are well supplied, through this arrangement, with blood-vessels, nerves, and absorbents.

What is meant by *Periosteum?* It is the fibrous membrane which surrounds bones except at their articular cartilages, and receives the insertion of tendons, ligaments, aponeuroses, &c.; that portion of this membrane situated on the skull is called pericranium. Its use is also to conduct the blood-vessels to the bones, give protection and shape to them, and to secrete bone in the growing state, or in fractures.

What is meant by the *medullary membrane?* It is a very delicate membrane of areolar tissue lining the internal and cellular structure of bone which secretes the medulla, and serves the purpose of an internal periosteum.

Are bones perfectly ossified at birth? No: the ends of the long bones are cartilaginous; the carpus and tarsus are nearly in the same state, and the processes generally are very imperfectly developed.

What are the *stages* of ossification? There are *three.* The first is the *gelatinous*, *mucous*, or *pulpy*, which exists during the first month; second, *cartilaginous*, commencing with the second month; and third, *osseous*, or *calcific*, which commences at the end of the second month in some of the bones: when ossification commences, the color of the cartilage becomes deeper, and in the middle of a yellow color; the vessels dilate, carry red blood, and a red point is perceived in the centre of the cartilage, which is called *punctum ossificationis*, from which the deposit increases on its surface. The long bones commence by a small ring, which extends itself. The flat irregular bones commence by one or more points, and radiate to the periphery. The short bones may have a single point or several, and they all grow by successive depositions on the outer surface or at the ends.

At what age are bones most dense? At the middle period of

life; and as age advances they grow lighter, more cellular and brittle, and the proportion of animal matter is diminished.

What is the process of the formation of *callus?* When a fracture takes place, there is effusion of blood into it; the soft parts swell; the blood is absorbed, and while this is going on, there is an effusion of coagulating lymph; an osseous ring is then formed around the seat of fracture, with a pin in its centre. Next, the extremities of bone begin to fuse themselves together; which when complete, the bony ring and pin, being superfluous, are absorbed, and the cavity, cellular structure, membrane, &c., are re-established. The process is entirely similar, in other respects, to the formation of new bone. In compound fractures, granulations frequently spring up from the surface of the bone in the same order as in the formation of new bone. Rest is important for the perfect performance of this process, or a false joint may result.

Trunk.

What constitutes the Trunk? The *Spine*, *Thorax*, and *Pelvis*.

Where is the *spine* situated? At the posterior part of the trunk, and extends from the head to the inferior opening of the pelvis.

What composes it? It consists of twenty-eight or twenty-nine distinct pieces, of which the upper twenty-four are true or movable vertebræ, the twenty-fifth is the sacrum or pelvic vertebra, and the remainder are the caudal vertebræ.

What are the *curvatures* of the spine? The *cervical* portion is convex anteriorly and concave posteriorly: *thoracic* portion concave in front and convex behind; *lumbar* portion convex in front and concave behind; *pelvic* and *caudal* concave in front and convex behind; and depend upon the different degrees of thickness of the bodies of the vertebræ and the intervening cartilages.

How are the *true vertebræ* divided? Into seven cervical, twelve dorsal, and five lumbar.

What does a vertebra consist of? A body, two laminæ, seven processes (two tranverse, one spinous, and four oblique), and a hollow for lodging the spinal marrow, which is formed by the body anteriorly and the laminæ posteriorly and laterally.

What characterizes a *Cervical vertebra?* Smaller than the others; longest laterally; spinal foramen large and triangular;

spinous process forked; transverse processes short, double, and perforated for the passage of the vertebral artery and vein. There are also differences between these vertebræ themselves.

What is the peculiarity of the first cervical vertebra, and what its name? It has no body or spinous process, being a simple ring, and is called *atlas;* the transverse processes project beyond those below.

What is there peculiar to the second cervical vertebra, and what is its name? It has upon its upper part a process called *odontoides* or *dens*, and the vertebra itself is called *vertebra dentata*, and also *axis.*

What characterizes the *Dorsal vertebræ?* Bodies longer antero-posteriorly, and more cylindrical than the cervical; their transverse diameter decreases from the first to the third, and then increases; the upper and lower margins and points of transverse processes are marked with small articular faces for articulating with the ribs; spinal foramen small and round, diminishing in size from first to third, and there increases to the last. The oblique processes are nearly vertical.

What characterizes a *Lumbar vertebra?* Body larger; long diameter transverse; spinal foramen triangular, and larger than the dorsal; transverse processes long, and stand out at right angles; spinous process thick, horizontal, and terminated in an oblong tubercle.

What are the points of ossification of the vertebræ? Except in the atlas, axis, and vertebra prominens, they are developed by three points, one for each lamella, and one for the body. Afterwards there are added to these six additional centres; one for each transverse process, two for the spinous process, and one for the upper and under surface of the body.

Where is the *Sacrum* situated, and what characterizes it? It is at the posterior part of the pelvis, forms part of its superior boundary, and is the pedestal of the spine. It is light and spongy in texture, triangular, concave anteriorly, and irregularly convex posteriorly, where it is divided by spinous processes; articulates laterally with the ossa innominata, and originally consisted of five pieces. It has four anterior and four posterior foramina; its canal is triangular, larger above than below, is continuous with the spinal canal, and contains the cauda equina. The anterior foramina

transmit the anterior nerves of the cauda equina, which form the great sciatic nerve.

What are the points of ossification of the sacrum? There are twenty-one points; five for each of the three first pieces, viz: — one for the body, one for each lateral portion, and one for each lamina; and three for each of the two last, viz:—one for the body, and one for each lateral portion.

What are the characteristics of the *Coccyx*? It resembles the sacrum, only much smaller, consists of four pieces—sometimes only three—united by fibro-cartilage, corresponds with the tails of animals, and is articulated superiorly to the sacrum. It is developed by four points of ossification, one for each piece.

What are the *uses* of the vertebral column? It gives a secure lodgment to the spinal marrow, is a line of support to the trunk, and the centre of its movements.

Where are the *Ossa Innominata* situated? They are two in number and situated on either side of the sacrum, form the lateral and anterior parts of the pelvis, and articulate with the os femoris on each side by the acetabula.

What are the original divisions of each os innominatum? *Ilium*, *ischium*, and *pubes*, all of which meet in the acetabulum.

What characterizes the *Ilium*? It is the largest of the three, forms the upper and rounded part of the innominatum, articulates with the sacrum, and forms two-fifths of the acetabulum, and may be described as divisible into an internal surface, the costa venter, which is concave, and an external surface or dorsum, which is convex and rough, and gives origin to the glutei muscles, a crest or spine, and an anterior and posterior border. The anterior superior spinous process in front gives origin to the sartorius, and tensor vaginæ muscles, and Poupart's ligament; the inferior spinous process gives origin to the rectus muscle; the space between the two gives origin to the gluteus medius. The ileo-pectineal prominence is below, in a groove above which pass the iliacus internus and psoas magnus muscles. The posterior superior and inferior spinous processes are posteriorly situated.

The crista has three lips; the transversalis muscle arises from the internal one; the internal oblique from the middle, and the external oblique is inserted into the external. The Sciatic notch is on the inferior border of the ilium.

What characterizes the *Pubis?* It is the anterior part of the innominatum, and is the smallest of the three; it is composed of a body and two large branches, one running downwards, called the ramus, to join the ischium—and the other backwards and upwards to the ilium, called the horizontal portion; it articulates with its fellow by a flat surface called the symphysis; it forms one-fifth of the acetabulum, and contributes to the formation of the obturator foramen.

What characterizes the *Ischium?* It forms the posterior inferior part of the os innominatum, is next in size to the ilium, triangular in form, its anterior extremity bends upwards to join the pubes, which is the crus, and the remainder is the body, the lower part of which is the tuberosity; it forms two-fifths of the acetabulum. At the middle of its posterior margin is the spinous process, to which is attached the lesser sacro-sciatic ligament.

What is meant by the *Thorax?* It is the upper part of the trunk, and is formed by the dorsal vertebræ behind, sternum in front, and by the ribs and their cartilages intermediate.

How are the *Ribs* divided? Into seven true and five false, on each side.

What characterizes the ribs? They are paraboloid, have an internal and external surface, an upper and lower margin, a sternal and vertebral extremity, an angle, head, tubercle, and neck. They are developed by three points, viz:—one for the central part, one for the head, and one for the tuberosity.

Where is the *Sternum* situated? In the middle front part of the thorax, and is divided into three portions, the lower of which is sometimes called *xyphoid* or *ensiform cartilage.* The points of ossification, or development, vary from six to fourteen in number.

The upper portion is thickest, and resembles a triangle with the corners removed, base upwards, a concavity above, one on each side for the articulation of the clavicles, and two smaller ones below for articulating with the first and second ribs.

The middle portion is longer and narrower, and has depressions on its sides for articulation with several of the ribs.

HEAD.

How are the bones of the head divided? Into those of the *cranium* and *face*.

What bones constitute the *Cranium*? The *os frontis, os occipitis*, two *ossa parietalia*, two *ossa temporum*, *os ethmoides*, and the *os sphenoides*. These form the cavity for the brain, which has three diameters: the antero-posterior, from the lower part of the os frontis to the protuberance on the middle of the inferior surface of the os occipitis, six and a half inches; the lateral includes the space between the superior margins of the ossa temporum, four and three-fourth inches; and the vertical, which is taken from the centre of the occipital foramen to the centre of the suture between the parietal bones, four and a half inches.

What are the characteristics of the *Os Frontis*? It forms the anterior, a portion of the superior, lateral, and inferior parietes of the cranium; external face convex, internal concave, symmetrical, and forms the upper and anterior part of the orbit. It has two internal and two external angular processes, a nasal process, two superciliary ridges, a temporal ridge, two orbitar plates or processes, two elevations of the frontal sinuses, two supra-orbital notches; and it articulates with the parietal, ethmoidal, and sphenoidal bones of the cranium, and several of the face. It is developed by two centres, one for each lateral half.

What are the characteristics of the *Ossa Parietalia*? They form the superior and lateral parts of the middle of the cranium; they are quadrilateral, convex externally, and concave internally, and each of them has a parietal eminence and a parietal foramen—one of these marks the centre of ossification, and the other transmits a vein to the superior longitudinal sinus; they are developed by single centres of ossification. They articulate together, with the frontal, the sphenoid, the temporal, and the occipital bones. They have each a deep groove commencing at their anterior inferior angle internally, for the middle meningeal artery.

What are the characteristics of the *Os Occipitis*? It is quadrilateral, resembling a trapezium, convex externally, and concave internally; both surfaces are modified by ridges and processes, viz:—on the external surface is the superior curved line, in the

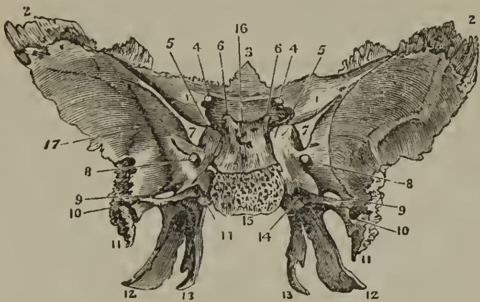
middle of which is the occipital protuberance; about three-fourths of an inch below this is the inferior curved line; there is also a condyle on each side for articulating with the atlas; and the basilar process in front of the foramen magnum. Upon its internal surface is a crucial ridge, the internal occipital protuberance, and the jugular eminence. It is developed by four centres; one for the posterior portion, one for each condyle, and one for the basilar process. It forms a large portion of the posterior and inferior parietes of the cranium, and has a large foramen called foramen magnum, which transmits the medulla spinalis, nervi accessorii, and the vertebral arteries and veins; the anterior condyloid foramen, which transmits the ninth pair of nerves; and the posterior condyloid, which transmits a cervical vein to the lateral sinus. It articulates with the parietal, temporal, and sphenoid bones.

Fig. 1.

What are the characteristics of the *Ossa Temporum?* They form portions of the inferior lateral parietes, and of the base of the cranium, have an irregular figure, and are divided into the anterior portion called squamous;[1] posterior, called mastoid,[2] and the middle or petrous[3] portion. The mastoid portion has cells or sinuses, which communicate with the tympanum. The elevations on each side are the mastoid, the zygomatic,[6] the styloid,[14] and the vaginal processes, the ridge internally, and the petrous[3] portion. The depressions are the glenoid cavity, the fissura Glasseri, a fossa, the digastric,[7] behind the mastoid process, and the temporal; a groove for the lateral sinus, and the occipital groove.[8] The foramina are the meatus auditorius internus[12,12] and externus, the

carotid,[16] the stylo-mastoid,[15] the Eustachian canal, and the openings of the aqueduct of the cochlea[17] and vestibule.[13] They are connected to the sphenoid, parietal, malar, and occipital bones by sutures; and are each developed by five centres of ossification; one for the squamous portion, one for the mastoid, one for the petrous portion, one for the auditory process, and one for the styloid process.

Fig. 2.



What are the characteristics of the *Os Sphenoides?* It is symmetrical, but very irregular, and placed across the middle of the base of the cranium. It consists of a body and large processes called the lesser[1,1] and greater[2,2] wings, the former of which are the apophyses of Ingrassias. There are also the pterygoid internal,[13] and external,[12] anterior[5] and posterior[6] clinoid, sphenoidal or azygos, olivary processes and ethmoidal spine.[3] The foramina are opticum,[4] lacerum superius[7] or sphenoidale,[7] ovale,[9] rotundum,[8] spinale,[10] and pterygoideum.[14] The sella turcica[16] is on the upper surface, and contains the pituitary gland. It articulates above and in front with the vomer, frontal, ethmoidal, malar, and parietal bones; laterally with the temporal; behind with the occipital,[15] and with the palate bones by the pterygoid processes; and is developed by twelve centres; four being for the body, four for the wings, two for the external pterygoid plates, and two for the sphenoidal spongy bones.

What do these foramina severally transmit? The opticum transmits the optic nerve and ophthalmic artery; the lacerum superius transmits the third, fourth, first branch of the fifth, and the sixth

pair of nerves; the rotundum transmits the second branch of the fifth pair of nerves; the ovale the third branch of the fifth pair; the spinale the middle artery of the dura mater; and the pterygoideum the pterygoid nerve, which is a recurrent of the second branch of the fifth pair.

What are the characteristics of the *Os Ethmoides?* (See Fig. 4, page 39.) It is situated between the orbitar processes of the os frontis; it is cuboidal, very light and cellular, and consists of a perpendicular lamella and two lateral masses. The part between the orbitar processes superiorly is called the cribriform plate,[5] with the crista galli[4] in the centre. The lateral masses are divisible into an internal and external surface, and four borders: on the internal surface is situated the superior meatus of the nose, above which is the superior turbinated bone, and below is the middle turbinated bone or process. The external surface is quadrilateral and smooth, hence named os planum;[9] it also forms part of the orbit of the eye. These masses are cellular, and divided into anterior and posterior ethmoidal cells. This bone articulates with thirteen others; two of the cranium, the rest of the face; it is developed by three centres, one for each lateral mass, and one for the perpendicular lamella.[6]

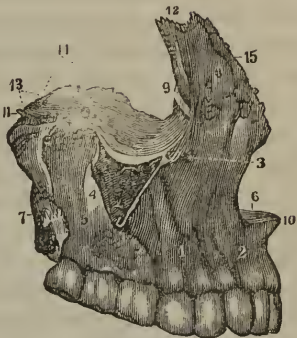
What is meant by the *pyramids of Wistar?* They are triangular hollow pyramids on the posterior part of each cellular portion of the ethmoid bone, consisting of a single cell; and the azygos process of the sphenoid bone is received between them. They are found in children from three to eight years of age. The pyramid towards puberty becomes a part of the sphenoid bone, and detaches itself from the ethmoid by a suture.

What composes the FACE? Fourteen bones; thirteen of which are in the upper jaw. They are the *ossa maxillaria superiora, ossa malarum, ossa nasi, ossa turbinata inferiora, ossa palati, ossa unguis*, and the *vomer*. The fourteenth is the *os maxillare inferius*.

What are the characteristics of the *Ossa Maxillaria Superiora?* They are distinguished by their superior size, and composing nearly the whole front of the upper jaw. They also form a portion of the orbit of the eyes, and have alveolar, malar,[4] nasal,[8] and palatine processes. They have also a large cavity in each, called the *antrum Highmorianum*, which communicates with the nose, a foramen

incisivum opening behind the incisor teeth, common to both; and each bone has a canal called infra-orbitar, opening on the front by the infra-orbitar foramen,[3] which transmits the infra-orbitar nerve and artery, and a canine[1] and sub-nasal[2] fossa. They articulate with the frontal,[12] nasal,[15] unguiform, malar, and ethmoidal bones[14] superiorly; behind to the palate and sphenoidal[7] bones;[13] in the middle to the vomer and to each other;[10] and by the nasal surface to the inferior spongy; and are each developed by six centres — one for the body, one for each of the three processes (nasal, malar, and palate), and two for the alveolar process.

Fig. 3.



What are the characteristics of the *Ossa Palati?* They are placed posteriorly to the superior maxillary bones, between them and the pterygoid processes of the sphenoid. — They are each divided into three portions; the horizontal or palate plate, the vertical or nasal plate, and the orbitar or oblique plate. They have six articulations, viz: — with the maxillary bones, sphenoid, ethmoid, inferior spongy, vomer, and with each other; and each bone is developed by a single centre.

What are the characteristics of the *Ossa Nasi?* They are two in number, and fill up the vacancy between the nasal processes of the superior maxillary bones, and form what is termed the bridge of the nose. They articulate with each other anteriorly, os frontis superiorly, upper maxillary posteriorly, and with the septum narium where they unite together in front; each bone is developed by a single centre.

What are the characteristics of the *Ossa Unguis?* They are small, and are placed at the internal side of the orbit, between the nasal processes of the upper maxillary bone and the planar plate of the ethmoid; assist in forming the ductus ad nasum, articulate loosely with the os frontis, upper maxillary, planar plate of the ethmoid, and inferior spongy bone of the nose; they are each developed by a single point of ossification.

What are the characteristics of the *Ossa Malarum?* They are situated at the external angle of the orbit of the eye, and form the middle and external parts of the face. They are quadrangular, with irregular margins, have superior and inferior orbitar, zygomatic, and maxillary processes. They articulate on each side with the maxillary, frontal, sphenoidal, and temporal bones; they are developed by a single point on each side.

What are the characteristics of the *Ossa Spongiosa Inferiora?* They are situated at the inferior and lateral parts of the nose, below the opening into the antrum Highmorianum; they have a concave and convex surface, with the concavity looking towards the maxillary bones.

What are the characteristics of the *Vomer?* It is placed between the nostrils, and forms a part of the septum. It articulates below with the nasal spine of the superior maxillary and palate bones, and above to the nasal lamella of the ethmoid and azygos processes of the sphenoid.

What are the characteristics of the *Os Maxillare Inferius?* It forms the lower boundary of the face, and is capable of motion. It is composed of a body and two extremities of rami; has alveolar processes, two angles, condyles, and coronoid processes; also two foramina, the anterior mental, which transmits a part of the inferior alveolar artery and nerve; and the posterior mental, through which the inferior alveolar artery and nerve enter; the middle union of the two sides is called symphysis.

How are the bones of the Cranium united? By *sutures;* they are the *coronal*, which unites the parietal and frontal bones; the *sagittal*, which unites the two parietal; the *lambdoïdal*, joining the parietal and occipital; and the two *squamous*, connecting the squamous part of the temporal and the parietal. In the lambdoidal are frequently found small bones called ossa *Wormiana*, or *Triquetra*, and occasionally these are found in the other sutures. The uses of the sutures are not fully settled among anatomists and physiologists.

What are the principal varieties of *sutures?* The *serrated*, where the union is formed by two borders of different bones possessing serrated edges. The *squamous*, where the union is formed by the overlapping of the bevelled edges of the two contiguous bones. The *harmonia*, where there is a simple apposition

of contiguous surfaces, being more or less rough and retentive. The *schindylesis*, where there is a reception of one bone into a sheath or fissure of another.

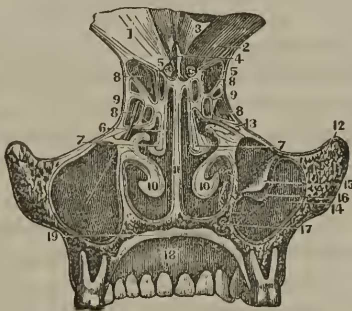
What is the structure of the bones of the cranium? They are composed of two tables united by cellular substance called *diploe*, which begins to show itself at two or three years of age. The internal table is thin and brittle, and is called *vitreous*.

How many bones enter into the composition of the Orbit? Seven; the frontal, the malar, the superior maxillary, the planar plate of the ethmoid, the unguiform, sphenoid, and palate.

What are the characteristics of the Nasal Cavity?

Irregular, separated from its fellow by a septum, and has three distinct meatuses or passages.

Fig. 4.



The *superior* has the posterior ethmoidal cells,[8] the sphenoidal cells, and the spheno-palatine foramen opening into it; its situation is between the superior and middle[7] turbinated bones. The *middle* meatus is found between the middle and inferior turbinated bones,[10] with the frontal sinus, anterior ethmoidal cells,[8] and the antrum[14] opening into it. The *inferior* is between the inferior turbinated bone[10] and the floor of the cavity, is the largest, and has the nasal duct opening into it.

The anterior opening is called the *anterior nares*, and the posterior opening the *posterior nares*.

Where is the Zygomatic Fossa situated? On either side of the head, and is formed by the parietal, sphenoid, temporal, and frontal

bones; the zygoma bounds it externally, and it is occupied by the temporal muscle.

Where is the Pterygo-Maxillary Fossa? At the bottom of the zygomatic fossa, and is formed by the superior maxillary, palate, and sphenoid bones. Its shape is triangular, base upwards; the ganglion of Meckel is contained in it, and gives off branches which pass through foramina opening upon this fossa.

Where is the *Os Hyoides* situated? At the root of the tongue within the circle of the lower jaw, and insulated, having no connection with any other bone except by muscles and ligaments. It is composed of a body, and a greater and lesser cornu on each side; and is developed by five points — one for the body, and one for each cornu; eleven pairs of muscles are attached to this bone.

Superior Extremities.

How are the superior extremities divided? They are divided on either side into *shoulder*, *arm*, *forearm*, and *hand*.

What *composes* the Shoulder? The *clavicle* and *scapula*, which occupy the superior, lateral, and posterior parts of the thorax.

What are the characteristics of the *Scapula*? It is on the posterior part of the thorax, and extends from the second to seventh rib inclusive; it is triangular, has an anterior face called venter, and a posterior face or dorsum, a superior edge or costa, an external edge or inferior costa, and a posterior or internal edge, termed the base; has three angles — one superior, one inferior, and the other anterior or external; a spine running from the posterior edge obliquely towards the anterior angle, rapidly increasing until it rises and is elongated forwards and upwards, and overhangs the shoulder-joint, and is called the acromion process; a cervix, coracoid process, and a glenoid cavity, for articulating with humerus. It is developed by six centres; one for the body, one for the coracoid process, two for the acromion, one for the posterior border, and one for the inferior angle; articulates with the clavicle and humerus; and has sixteen muscles attached to it, viz: — subscapularis, supra and infra-spinatus, omo-hyoid, levator anguli scapulæ, rhomboideus major and minor, serratus magnus, long head of triceps, teres minor and major, long and short tendon of biceps, trapezius, deltoid, pectoralis, minor and coraco-brachialis.

The ligaments attached to the coracoid process are the coracoid, coraco-clavicular, and humeral, and the costo-coracoid membrane.

What are the characteristics of the *Clavicle?* It is a long bone situated transversely at the superior and anterior parts of the chest, extending from the sternum to the acromion process of the scapula; it is compared in shape to the letter *f*, and is divided into body, sternal, and scapular extremities. It is developed by two centres; articulates with the sternum and scapula; and has six muscles attached to it, viz:—sterno-mastoid, trapezius, pectoralis major, deltoid, subclavius, and sterno-hyoid.

What are the characteristics of the *Humerus?* It is cylindrical, both extremities enlarged; the superior is called its head, which is hemispherical, and attached to the body of the bone by the neck; it has two tuberosities, external and internal, between which is the bicipital groove; two sigmoid cavities; one receives the coronoid, and the other the olecranon process of the ulna; and two condyles. The part between the extremities is termed body. It is developed by seven centres; articulates with the glenoid cavity of the scapula, and with the ulna and radius; and has twenty-four muscles attached to it. In the motions of the shoulder joint it is susceptible of elevation, depression, advancing, retreating, circumduction, and rotation.

What are the bones of the *Forearm?* The ulna and radius.

What are the characteristics of the *Ulna?* It is situated on the inside of the forearm with the little finger; nearly straight, much larger at the upper than at the lower extremity; the upper or humeral extremity has an olecranon and a coronoid process, with the greater sigmoid cavity between them for articulating with the humerus, and the lesser on the radial surface of the coronoid for articulating with the head of the radius; the lower extremity has a styloid process and an articular surface for articulating with the carpus, and one for articulating with the radius. It is developed by four centres; articulates with the humerus and radius; and has twelve muscles attached to it.

What are the characteristics of the *Radius?* It is the rotary bone of the forearm, shorter than the ulna, situated exteriorly to it, and extends from the os humeri to the wrist; it is smaller at the upper than at the lower extremity; and has a head, neck, tuberosity, and styloid process. It is developed by three centres,

articulates with the humerus, ulna, scaphoid, and semilunar bones; and has nine muscles attached to it. The forearm executes upon the arm, flexion, extension, and lateral inclination.

What composes the *Hand?* The *carpus*, *metacarpus*, and *phalanges* or *digiti*.

What are the bones of the *Carpus?* There are two rows: in the first are the scaphoides, lunare, cunciforme, and pisiforme; in the second are the trapezium, trapezoides, magnum, and unciforme.

Where is the *Metacarpus* situated? Between the carpus and phalanges of the fingers and thumb, and are five in number.

How many *Phalanges* are there? Fourteen; three for each finger and two for the thumb; the bone adjoining the metacarpus is the first, the middle is the second, and the other the third.

Inferior Extremities.

What are the bones of each inferior extremity? The *os femoris*, *tibia*, *fibula*, *patella*, *tarsus*, *metatarsus*, and *phalanges*.

What are the characteristics of the *Os Femoris?* It is the largest bone in the human body; at its superior extremity it has three well marked eminences, the head, and greater and lesser trochanters; the head is supported by the neck, which projects from the body of the bone between the trochanters; the line between the trochanters is called the linea quadrata. Its inferior extremity is larger, and divided into two parts, the internal and external condyle. The linea aspera begins broad, rough, and flat, on a level with the trochanter minor; as it descends, it becomes more elevated, and its lower extremity divides into two superficial ridges, one running to each condyle. It is developed by five centres; one for the shaft, one for each extremity, and one for each trochanter; and has twenty-three muscles attached to it. Its motions consist in extension, flexion, abduction, adduction, rotation, and circumduction.

What are the bones of the *leg?* The *tibia*, *fibula*, and *patella*.

What are the characteristics of the *Tibia?* It is on the internal side of the leg, and extends from the thigh to the foot; it is the longest and largest bone in the body, except the femur; the superior extremity is much larger than the inferior; its inferior internal part is called the internal malleolus. It has also an elevation called

spinous process, and another called the tubercle; it is developed by three centres; one for the shaft, and one for each extremity; and has ten muscles attached to it. Flexion, extension, and partial rotation, are the motions of the leg upon the thigh.

What are the characteristics of the *Fibula?* It is at the external side of the tibia, and extends from its head to the foot; its inferior and external part is called the external malleolus. This bone is developed by three centres; and has nine muscles attached to it. The tibia and fibula articulate below with the astragalus.

What are the characteristics of the *Patella?* It is small, intermediate to the thigh and leg, and placed on the front of the knee-joint; its anterior face convex and rough; and its circumference is nearly oval, with the long diameter transverse.

How is the *foot* divided? Into *tarsus*, *metatarsus*, and *toes* or *phalanges.*

What composes the *Tarsus?* Seven bones; viz., *os calcis*, the *astragalus*, the *naviculare*, the *cuboides*, the *cuneiforme externum*, *cuneiforme medium*, and *cuneiforme internum.*

Cartilage.

What are the characteristics of *Cartilage?* It is a substance of a white or pearly color, hard, flexible, very elastic, found in various parts of the body, especially on the articular surfaces of bones, the end of the nose, the edges of the eyelids, the ear, windpipe, end of ribs, &c. It contains no red blood-vessels, nerves, nor lymphatics. The chemical analysis is: gelatin, 44.5; water, 55; phosphate of lime, 0.5.

How are the cartilages *divided?* Into *articular*, or those which cover the surface of bones in movable joints; the *interarticular*, or those which are interposed between the ends of bones to form a movable socket; the *connecting*, or those which unite the articular surfaces of bones by an immovable union, as the sutures of the skull, the connections between the bones of the pelvis, &c.; and the *cartilage of cavities*, or those which form the larynx, trachea, part of the nose, &c.

What is the membrane surrounding cartilage called? *Perichondrium*, and it is similar to the periosteum.

Of Ligaments.

What are the characteristics of the *ligamentous* or *desmoid tissue*, called also *fibrous tissue?* It may be known by its whiteness, firmness, the unyielding nature of its materials, and its fibrous arrangement. It is very generally diffused in the human body, and has a very close connection with the cellular texture; it also serves the purpose of connecting the bones in their articulations. The sensibility of this system is extremely obscure; the usual mechanical and chemical irritants do not affect it; it may, however, be produced by a twisting motion, or when under a state of inflammation, as in gout, rheumatism, &c. There are two kinds, the *white*, found in tendons, fasciæ, and most of the ligaments; and the *yellow*, which is found in the ligamentum nuchæ, in many vessels and ducts, and is elastic.

What is meant by *Ligaments?* They are those organs which tie the bones together, and in the movable joints are divided into the *capsular*, and the *funicular*. The first are open at the end, and envelope the ends of the bones, extending from one to the other; the second are mere cords, extending from one bone to the other, and may be flattened, round, or oval; they may be either internal or external to the capsular ligament; their study is called *syndesmology*.

What are the characteristics of the *Fibro* or *Ligamento-cartilaginous* system? It partakes of the character of both ligament and cartilage, and the constituents of which consist of a strong fibrous matter, intermixed with cartilage.

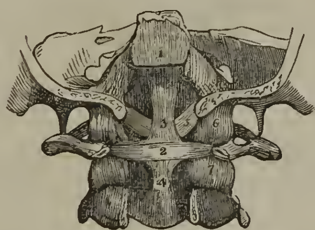
What are the different forms of articulation that are met with in the human body called? *Synarthrosis*, *amphi-arthrosis*, and *diarthrosis*. In the *first* of these, the bones are immovably connected with each other. *Amphi-arthrosis* is a joint intermediate, in aptitude for motion, between the immovable synarthrosis and the movable diarthrosis; it is of a mixed character, being partly lined by synovial membrane, and partly by the intervention of interosseous ligaments. Examples of this union may be seen in the connection of the vertebræ. *Diarthrosis* is the movable articulation: of which we have examples in the great number of the joints of the body.

What is meant by a *Synovial membrane?* It is a membrane lining each movable articulation, reflected over the internal face of the capsular ligament and the articular cartilages; it is a perfect sac, and differs from the capsular ligament in having no opening in it; it is white, thin, semi-transparent, and soft, belongs to the class of serous membranes, and the fluid secreted by it is called synovia, the use of which is to diminish friction, and facilitate motion.

What are the structures entering into the composition of a joint? *Bone, cartilage, fibro-cartilage, ligaments,* and *synovial membrane.*

What enters into the *Articulation* of the *Lower Jaw?* Besides the bones tipped with their cartilages, there is a capsular ligament, an internal, external, and stylo-maxillary ligament, and a small triangular ligament discovered by Caldani, two synovial membranes, an interarticular cartilage, and an erectile tissue. The movements of the lower jaw are depression, elevation, a forward and backward movement, and a movement from side to side.

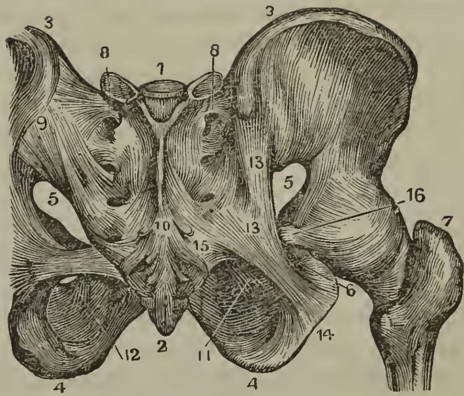
Fig. 5.



What are the *Ligaments* of the *Vertebræ?* The *intervertebral, anterior* and *posterior*[1] *vertebral,* a *capsular*[6,7] at the articulations of the oblique processes, *interosseous, ligamentum nuchæ, ligamenta flava* (23 pairs); between the occiput and atlas are the *anterior* and *posterior,* between the second and first vertebræ and the occiput are the *lacerti ligamentosi, transverse,*[2] with the upper[3] and lower[4] appendices, *oblique* or *moderator,*[5] and *middle* or *straight ligaments.*

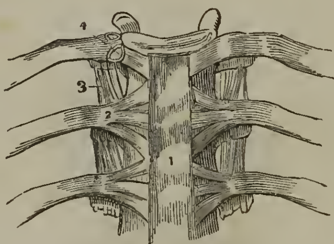
What are the *Ligaments* of the *Pelvis?* The *anterior* and *posterior*[10] *coccygeal, ilio-lumbar, sacro-spinous,*[9] *sacro-iliac,*[8] *pos-*

Fig. 6.



terior sacro-sciatic,[13, 14] *anterior sacro-sciatic,*[15, 16] *obturator,*[11] *anterior pubic* and the *sub* or *inter-pubic* ligaments.

Fig. 7.



What are the *Ligaments* at the posterior articulation of the *Ribs?* The *anterior* or *radiating,*[2] *interarticular,*[4] *two capsular* for the head of each, and *one* where they are articulated with the transverse processes of the vertebræ, the *internal transverse,*[3] the *external transverse,* and *middle costo-transverse ligaments.*

What are the ligaments of the *anterior articulation* of the *ribs?* There are two, an *anterior*[5] (Fig. 8), a *posterior*, and the *costo-xiphoid ligaments;* also a synovial membrane imperfectly developed.

What are the ligaments and parts concerned in the articulations of the anterior end of the clavicle? The *capsular*[1] and *interclavicular*[2] ligaments; an *interarticular cartilage;*[4] two

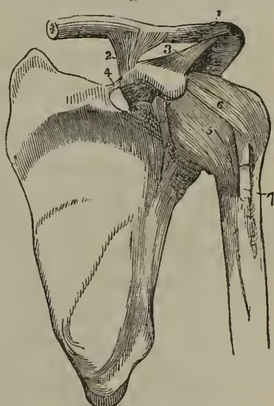
Fig. 8

synovial membranes; and the *rhomboid*[3] ligament, connecting the first rib with the clavicle.

What is meant by the *Articulation of the Shoulder?* It is the junction of the clavicle to the upper part of the sternum and first rib; of the scapula to the clavicle; and of the humerus to the scapula.

What ligaments are concerned in the *scapulo-clavicular articutions?* The *capsular*, the *coraco-clavicular*[2] which is divided into the *conoid* and *trapezoid, bifid, coracoid,*[4] and the *triangular*[3] ligaments, or *coraco-acromialis.*[3]

Fig. 9.



What ligaments are concerned in the *scapulo-humeral articulation?* The *capsular,*[5] the *long head of the biceps,*[7] *coraco-humeral*[6] or *ligamentum adscititium,*[6] and the *glenoid* ligament, which surrounds the glenoid cavity. This joint is capable of every variety of motion, viz: — of movement forwards and backwards, of abduction and adduction, of circumduction and rotation.

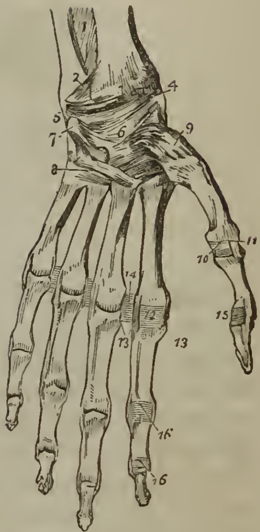
What are the *ligaments* of the *elbow joint?* The *capsular*[1] (Fig. 10), *annular,*[5,6] and[3] (Fig. 11), or *coronary external*[4] (Fig. 10), and *internal lateral*[2,2] (Fig. 11), ligaments.

What *ligaments* are situated *between* the *radius* and *ulna?* The *interosseous*[5] (Fig. 11), the *round*[4] (Fig. 11), ligaments (or *ligamentum teres*[4]), and the *capsular* (Fig. 11), or *sacciform* at their lower extremities.

Fig. 10.

Fig. 11.

Fig. 12.



What are the *ligaments* of the *wrist-joint?* The *internal*[5] (Fig. 12) and *external*[6] *lateral, capsular,*[6] *dorsal, radio-ulnar,*[2] and *palmar*[3] ligaments. The movements of the joint are flexion, extension, adduction, abduction, and circumduction. There are also ligaments connecting the second row of the carpus with the metacarpus;[8] a *capsular ligament*[9] for the carpo-metacarpal joint of the thumb, and one for the metacarpo-phalangial joint,[10] and an *external lateral*[11] for the same joint; a *capsular* ligament[12] of the metacarpo-phalangial articulation of the index finger, *lateral*[13,13] ligaments for similar articulations, and *inferior palmar*[14,14] ligaments.

Fig. 13.

What are the *ligaments* of the *ilio-femoral* (Fig. 13) or *hip articulation?* The *cotyloid*, which tips the margin of the acetabulum, the *interarticular* or *round*, and the *capsular*[8] *ligament* The

movements are flexion, extension, adduction, abduction, circumduction, and rotation. The cut represents the *sacro-vertebral,*[2] the *ilio-lumbar,*[3] the *anterior portion* of the *sacro-iliac.*[4] The *lower part* of the *anterior vertebral,*[1] *Poupart's ligament,*[6] and that portion of it called *Gimbernat's,*[7] the *accessory*[9] of the hip-joint, and the *obturator*[5] ligaments.

What are the ligaments and parts concerned in the *knee-joint?* The *capsular ligament*, or *involucrum generale*, the *ligament* of the *patella*[8] (Fig. 15), a *posterior*[1] (Fig. 14), or *ligament of*

Fig. 14.

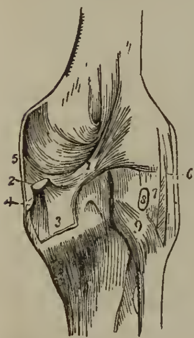


Fig. 15.

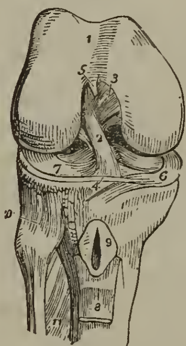


Fig. 16.

Winslow[1] (Fig. 14), *internal*[5] and *external*[6] *lateral* (Fig. 14), and *two crucial*[2,3] (Fig. 15) ligaments. This joint has also *two semilunar cartilages*[6,7] (Fig. 15), and its motions are those of flexion and extension. The superior peroneo-tibial articulation[10] (Fig. 15), and the interosseous ligament;[11] the posterior superior peroneo-tibial ligament[9] (Fig. 14). Fig. 16 represents a longitudinal section of the knee-joint, showing the cellular structure of the lower end of the femur and tibiæ,[1] the patella[3] with its ligament,[4] the large bursæ[6] under it, the ligamentum mucosum,[10] the anterior crucial ligament,[11] and the tendon of the quadriceps femoris.[2]

How are the *tibia* and *fibula* united together? They are united superiorly by an *anterior* and *posterior* ligament, and a *synovial membrane;* inferiorly also by an *anterior* and *posterior* liga-

ment; and the bodies of these bones are united by an *interosseous* ligament.

What are the ligaments of the *ankle-joint?* An imperfect *capsular*, an *internal*, and an *external lateral* ligament.

What ligaments connect the *os astragalus* and *os calcis?* The *interosseous*, *posterior*, and *deltoid* ligaments.

What connects the *astragalus* with the *scaphoides?*

It is connected above by a *broad thin* ligament; below by *two* ligaments, *internal* and *external calcaneo-scaphoid*.

What connects the *calcis* with the *cuboides?* The *superior* and *inferior calcaneo-cuboid* ligaments.

Of the Integuments.

What is meant by the integuments of the body? The *cellular* and *adipose substances*, and the *dermoid covering*.

What are some of the properties of *cellular tissue?* It is an elementary tissue, generally disseminated over the whole body; found beneath the skin; between muscles; connecting membranes and other parts; entering into their composition; indispensable to their texture; and precedes them in the development of the fœtus. It is composed of cells which communicate freely with each other, and may be distended either with air or other fluids, and from its elasticity when the distension is removed it will return to its original shape.

Where is the *adipose structure* found? Between the skin and the fascia, in the layers of condensed cellular substance, next to the muscles, as the face, neck, trunk of the body, buttocks, limbs, palms of the hands, soles of the feet, &c. In chemical composition — for which, see Animal Chemistry — it differs from all other parts of the body in containing no nitrogen. It is enclosed by cellular substance.

What is meant by the *dermoid covering?* The *skin;* its *sebaceous* and *perspiratory organs;* the *nails;* and the *hair*.

How many *lamina* does the skin consist of? Two, the *cutis vera*, and the *cuticula*. What was formerly called *rete mucosum*, and which contains the coloring matter, is merely the deeper or more recently formed portion of the cuticle or epidermis.

What is understood by the *sebaceous organs?* The follicles and glands which furnish the oily exhalation that lubricates the surface of the skin.

What is meant by the *perspiratory organs?* They are bodies called *sudoriparous* glands, contained in the cutis vera and subcutaneous cellular tissue. They each consist of a cylindrical tube, generally extending from the under surface of the true skin to the surface of the cuticle. The first portion is tortuous, and collected into a small spherical ball surrounded by fat vesicles, from which the tube proceeds in an irregular and tortuous manner to the surface, and opens by a conical orifice on the ridges of the cutis vera made by the papillæ tactus.

What are the *nails?* They may be considered as a continuation of the cuticle, supply its place on the extremities of the fingers and toes, and correspond with the talons and hoofs of animals. They are devoid of organization. Each one consists of a root, a body, and a free extremity.

What are the *hairs?* They are cylindrical filaments found on most parts of the skin excepting the palms and soles. They have no blood vessels or nerves, but probably have a species of interstitial circulation.

OF MUSCLES.

What are the *properties* of muscles? They are the organs of motion, and are characterized by *redness, softness, irritability, contractility,* and by being formed of long, parallel fibres, which are arranged into fasciculi; each fibre extending the whole length of the muscle, considering the length as represented by the tendinous beginning on one hand, and the tendinous termination on the other.

How are they divided? Into *voluntary* and *involuntary.*

What is meant by the *myotility* of muscles? It is their power of contraction, elongation, and remaining fixed.

What does a muscle consist of? A belly and two extremities; the one that is fixed is called the head or origin, and the other is the tail or insertion. Those which surround orifices are called

sphincters. The belly or body is the fleshy part, and the extremities are tendinous. In the most simple muscles, the fibres run in the direction of their length, and are termed *fusiform*. Those which run obliquely from a tendon or bone are called *semi-pennati*. Those which converge obliquely to a tendon in the centre are called *pennati*. Others again are formed of a congeries of smaller muscles, the fibres of which run in different directions and intermix with tendinous matter, as the deltoid and subscapular. Muscles are composed of bundles of fibres, each consisting of filaments; the filaments are divisible into fasciculi, and each fasciculus consists of a number of primitive particles or *sarcous* elements held together by a tough, delicate, and elastic membrane called *sarcolemma*. They are well supplied with blood-vessels and nerves. Various stimuli applied to muscular fibre will cause contraction. The general phenomena manifested by, or capacity of a muscle, are termed myotility; they are contraction, elongation, and power of remaining fixed.

Upon what does the strength of a muscle depend? Upon the number of its fibres; so that those whose fibres run obliquely are stronger than those which run longitudinally.

How are tendons distinguished? By their white and shining appearance; they have no elasticity or power of elongation or contraction; they have two general shapes: *funicular*, or like cords; and *membranous*,[2] or resembling an aponeurosis.

Trunk.

Abdomen.

Where is the *fascia superficialis abdominis* situated? Beneath the skin of the abdomen, and consists of a layer of condensed cellular substance. It is laminated, admits of being dissected into layers, and encloses the lymphatic glands in the groin.

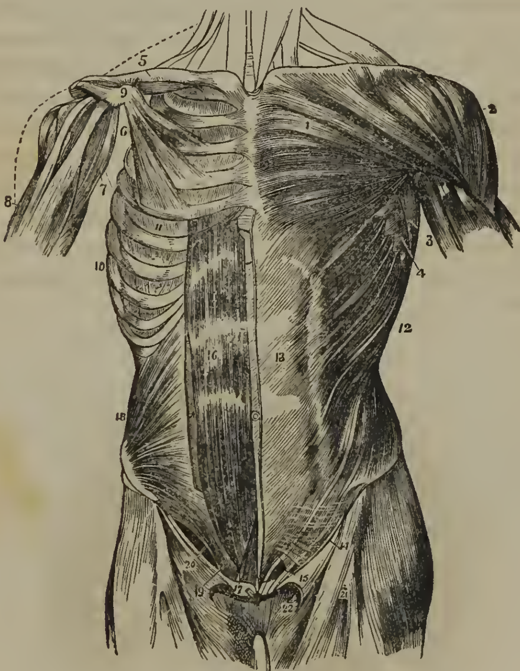
What are the *origin*, *insertion*, and *use* of the following muscles?

Obliquus externus.[12] (See Fig. 17.) Origin, eight or nine inferior ribs. Insertion, ensiform cartilage, linea alba, pubis,

Poupart's ligament,[11] and anterior two-thirds of the crest of the ilium. Use, to compress the abdomen.

Obliquus internus.[18] Origin, fascia lumborum, crest of ilium, and external third of Poupart's ligament. Insertion, into the cartilages of the seven inferior ribs, ensiform cartilage, linea alba, symphysis, and upper edge of the pubis. Use, to bend the body and compress the abdomen.

Fig. 17.



Cremaster. Origin, Poupart's ligament and obliquus internus. Insertion, tunica vaginalis testis, and scrotum.

Transversalis. Origin, fascia lumborum, crest of ilium, Poupart's ligament, and seven lower ribs. Insertion with the obliquus internus. Use, to compress the abdomen

Rectus.[16] Origin, pubis. Insertion, ensiform cartilage, and to the cartilages of the fifth and sixth ribs. Use, to bend the trunk, and compress the abdomen.

Pyramidalis.[17] Origin, pubis. Insertion, linea alba.

What other parts are exhibited by Fig. 17? *Common tendon* of the internal oblique and transversalis;[19] *crural arch;*[20] *fascia lata* femoris;[21] *saphenus opening, external abdominal ring,*[5] and *Poupart's ligament.*[14]

Where is the *fascia transversalis* situated?

It covers the abdomen, lies under the muscles and in front of the peritoneum; it is continuous with the iliac fascia which surrounds the posterior part of the peritoneum, and the pelvic fascia which surrounds that portion of peritoneum in the cavity of the pelvis. The internal abdominal ring is situated in it. The term *ring* is liable to be misunderstood; it means here simply that point where the fascia transversalis ceases to cover the abdomen, and commences to cover the cord; it is very thin at this place, and an artificial dissection may readily form an opening or ring with a well defined edge, although it does not exist in the natural state of the parts.

Fig. 18.

Diaphragm[1,2,3] (Fig. 18). The greater muscle. Origin, xiphoid cartilage, the cartilages of the last true and all the false

ribs. Insertion, cordiform tendon.—The lesser muscle or crura,[8, 10]. Origin, the bodies of the first four lumbar vertebræ. Insertion, cordiform tendon. What parts are to be noticed about the diaphragm? The *ligamentum arcuatum*,[5] point of origin of the psoas magnus,[6] the small triangular space behind the sternum[4] covered only by serous membrane, and through which herniæ sometimes pass; hiatus articus,[11] foramen œsophageum,[12] foramen quadratum,[13] and a small opening for the lesser splanchnic nerves.[7]

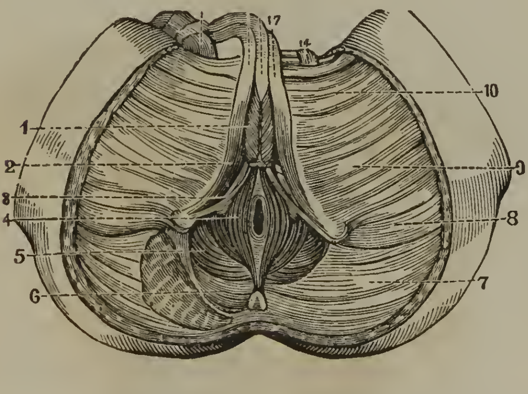
Quadratus lumborum.[15] Origin, spine of ilium. Insertion, transverse processes of lumbar vertebræ, and last dorsal. Use, to bend the trunk to one side and forwards.

Psoas muscles.[14] Origin, the lumbar and dorsal vertebræ. Insertion, cavity of the pelvis, and lesser trochanter.

Iliacus internus. Origin, transverse process of last lumbar vertebra, crest of ilium, and iliac fossa. Insertion with the psoas muscles into the femur. Use, to bend the thigh and body.

What are the muscles of the *male* perineum?

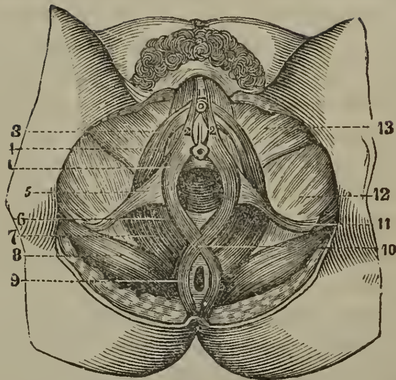
Fig. 19.



Sphincter ani,[4] *externus* and *internus*, *erector penis*,[2] *accelerator urinæ*[1] or *ejaculator seminis*, *transversus perinei*,[3] *levator ani*,[5] *compressor urethræ*, and *coccygeus*.[6]

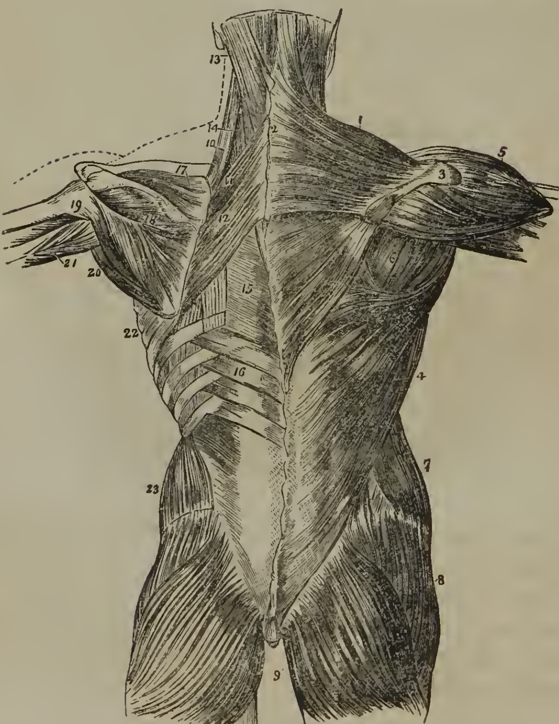
What are the muscles of the *female* perineum? *Sphincter vaginæ*,[1,2] *erector clitoridis*,[3,4] *transversus perinei*,[5,11] *levator ani*,[7] *sphincter ani*.[9]

Fig. 20.



Back.

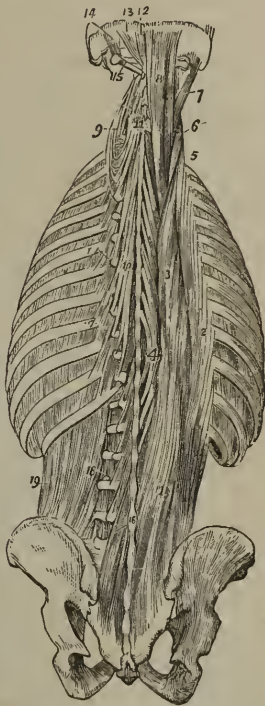
Fig. 21.



What are the *origin*, *insertion*, and *use* of the following muscles?

Trapezius.[1,2] Origin, occipital bone, ligamentum nuchæ, last cervical, and the dorsal vertebræ. Insertion, clavicle, acromion process, spine of the scapula. Use, to draw the parts in the several directions of its fibres.

Fig. 22.



Latissimus dorsi.[4] Origin, dorsal spines, fascia lumborum, sacrum, ilium, and three or four last ribs. Insertion, humerus. Use, to draw the os humeri downwards, and backwards.

Rhomboideus major and *minor.*[11,12] Origin, ligamentum nuchæ, and dorsal spines. Insertion, base of the scapula. Use, to draw the scapula up and back.

What other muscles are situated on the back? *Levator anguli scapulæ,*[10] *splenius capitis*[13] *and colli,*[14] *sacro-lumbalis*[2] (Fig. 22), *longissimus dorsi,*[3] *spinalis dorsi*[4] (Fig. 22), *musculi accessorii, cervicalis descendens,*[5] *transversalis cervicis,*[6] *trachelo-mastoideus,*[7] *complexus,*[8] *semi-spinalis colli*[11] *and dorsi,*[10] *multifidus spinæ,*[16] *rectus capitis posticus major*[13] *and minor,*[12] *obliquus superior*[14] *and inferior,*[13] *interspinales, intertransversarii,*[18] *levatores costarum,*[17] *spinalis dorsi,*[4] *serratus major anticus,*[22] and *serratus inferior posticus*[16] (Fig. 21).

Thorax. (See Fig. 17.)

What are the *origin*, *insertion*, and *use* of the following muscles?

Pectoralis major.[1] Origin, sternal half of clavicle, anterior surface of sternum, cartilages of the third, fourth, fifth, and sixth true ribs. Insertion, humerus, anterior edge of bicipital groove. Use, to draw the arm inwards, forwards, and to depress it.

Pectoralis minor.[6] Origin, upper edge of fourth, fifth, and

sixth ribs. Insertion, coracoid process of scapula. Use, to draw it in, and down.

Subclavius.[5] Origin, first rib. Insertion, clavicle.

Serratus magnus.[4, 10] Origin, eight or nine superior ribs. Insertion, base of scapula. Use, to draw it forwards.

Intercostales external.[11] Origin, eleven inferior ribs at their external, inferior edges. Insertion, superior edge of ribs beneath.

Internal. Origin, eleven ribs internally, from the lower edge of each. Insertion, inner lip of the rib beneath. Use, to draw the ribs together.

Triangularis sterni. Origin, lower part of sternum. Insertion, cartilages of fourth, fifth, and sixth ribs. Use, to diminish the cavity of the thorax, *pectoralis minor.*[6]

Neck.

Fig. 23.

What are the *origin, insertion,* and *use* of the *platysma myoides?*[19] (Fig. 24.) Origin, cellular membrane over deltoid and pectoral muscles, and from the clavicle. Insertion, chin and fascia of the lateral and inferior parts of the face. Use, to elevate the skin of the neck.

Sterno-cleido-mastoideus[13, 12, 11]. Origin, sternum and clavicle.

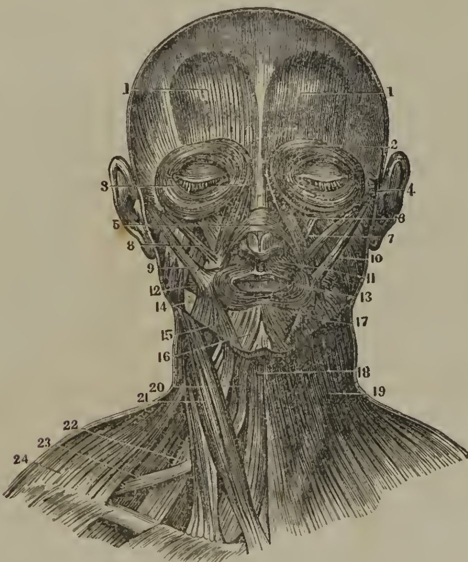
Insertion, mastoid process and transverse ridge of the occipital bone. Use, to draw the chin towards the sternum.

What other muscles are there of the neck, the names of which mostly indicate their attachment? *Sterno-hyoideus, sterno-thyroideus, thyreo-hyoideus, omo-hyoideus, mylo-hyoideus,*[14] *stylo-hyoideus,*[4] *stylo-glossus,*[9] *stylo-pharyngeus,*[10] *genio-hyoideus, longus colli, rectus capitis anticus major, minor,* and *lateralis, scalenus anticus,*[20] *medius*[22] and *posticus.*[21]

HEAD.

Face.

Fig. 24.



What are the *origin, insertion,* and *use* of the *occipito-frontalis?*[1] Origin, superior transverse ridge of the occipital bone and mastoid process. Insertion, integuments and muscles of eyebrows. Use, to corrugate the forehead and elevate the supercilia.

Corrugator supercilii. Origin, internal angular process of os

frontis. Insertion, middle of eyebrow. Use, to draw the lower part of the forehead into vertical wrinkles.

Compressor naris.[5] Origin, root of ala nasi. Insertion, into its fellow, and lower part of os nasi.

Orbicularis palpebrarum.[2] Origin, nasal process of os maxillare superius, internal angular process of os frontis, and from os unguis. Insertion, orbitar and nasal processes of maxillary bone and palpebral ligament. Use, to close the eyelids.

Levator labii superioris et alœ nasi.[6] Origin, nasal and orbitar processes of superior maxillary bone. Insertion, side of ala nasi, and upper lip. Use, to draw the upper lip and ala nasi upwards.

Levator anguli oris.[7] Origin, anterior part of superior maxillary bone. Insertion, corner of the mouth. Use, to raise the angle of the mouth.

Zygomaticus major and minor[8, 9]. Origin, fore part of malar bone. Insertion, corner of the mouth. Use, to draw the corner of the mouth towards cheek bone.

Depressor labii superioris et alœ nasi.[11] Origin, inferior part of upper maxillary bone. Insertion, side of ala nasi and contiguous part of upper lip. Use, to depress the upper lip and ala nasi.

Depressor anguli oris.[15] Origin, base of lower jaw. Insertion, corner of mouth. Use, to draw the corner of mouth downwards.

Depressor labii inferioris.[16] Origin, basis of lower jaw. Insertion, side of lower lip. Use, to draw the lower lip downwards.

Levator menti et labii inferioris. Origin, incisive fossa of lower jaw. Insertion, inteGuments of the chin. Use, to raise the integuments of the chin.

Buccinator.[12] Origin, coronoid process of lower maxilla and back part of upper maxilla. Insertion, corner of mouth and contiguous parts of upper and lower lips.

Orbicularis oris.[13] This is a sphincter muscle which surrounds the mouth; consequently, it has neither origin nor insertion.

Lower Jaw.

Temporalis. Origin, semicircular ridge on parietal bone, temporal fossa, and fascia. Insertion, coronoid process of lower jaw. Use, to pull it directly up.

Masseter.[10] Origin, superior maxillary bone and zygoma. Insertion, outer surface of angle of lower jaw.

Pterygoideus internus. Origin, internal side of external pterygoid plate. Insertion, inner side of angle of lower jaw. Use, to close the jaw and produce a grinding motion.

Pterygoideus externus. Origin, outer side of external pterygoid plate. Insertion, internal part of neck of lower jaw. Use, same as former.

Digastricus[1,2] (Fig. 23). Origin, groove at base of mastoid process; in its course it is attached to the os hyoides by a ligament. Insertion, inner side of base of jaw. Use, to open the mouth.

Upper Extremity.

Shoulder.

What are the *origin*, *insertion*, and *use* of the following muscles? (See Fig. 21.)

Deltoides. Origin, lower edge of spine of scapula, acromion, and outer third of clavicle. Insertion, humerus, near its middle. Use, to raise the arm.

Supra-spinatus.[17] Origin, scapula above its spine. Insertion, great tuberosity of humerus. Use, to raise the arm and turn it out.

Infra-spinatus.[18] Origin, scapula below the spine. Insertion, great tuberosity of humerus. Use, to roll the arm.

Teres minor.[19] Origin, inferior costa. Insertion, great tuberosity of the humerus. Use, to rotate and draw the arm down and back.

Teres major.[20] Origin, inferior angle of scapula. Insertion, inner edge of bicipital groove. Use, to rotate the arm inwards, and draw it back.

Subscapularis.[4] Origin, subscapular fossa. Insertion, small tubercle of humerus. Use, to draw the arm down and roll it in.

Arm.

Biceps.[2,8,5,12,20,21] Origin, coracoid process and edge of glenoid cavity. Insertion, tubercle of radius. Use, to flex the forearm.

Fig. 25.

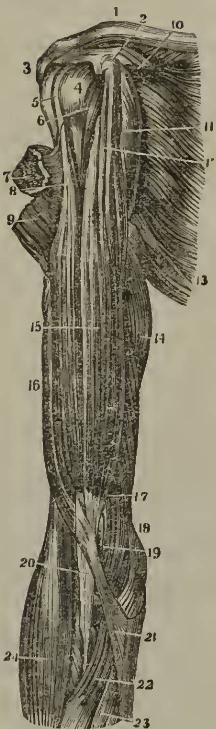


Fig. 26.

Coraco-Brachialis.[11] Origin, coracoid process. Insertion, internal side of humerus near the middle. Use, to draw the arm up and forward.

Brachialis internus.[19, 17] Origin, centre of humerus. Insertion, coronoid process of ulna. Use, to flex the forearm.

Triceps extensor cubiti.[16] Origin, neck of scapula, outer side of humerus, ridge leading to internal condyle of humerus. Insertion, olecranon process. Use, to extend the forearm.

Forearm.

What class of muscles take origin from the internal condyle and anterior part of ulna? The *flexors* and *pronators*.

What are the flexors and pronators? *Pronator radii teres*,[4] *flexor carpi radialis*,[5] *palmaris longus*,[6] *flexor carpi ulnaris*.[8]

Flexor digitorum sublimis perforatus.[7] Origin, inner condyle and radius. Insertion, second phalanx. Use, to bend the second phalanx.

Flexor digitorum profundus perforans. Origin, ulna, radius, and interosseous ligament. Insertion, last phalanx.

Flexor longus pollicis. Origin, radius. Insertion, last phalanx of thumb.

Pronator radii quadratus. Origin, anterior surface of ulna. Insertion, anterior part of radius.

What class of muscles take origin from the external condyle and posterior part of ulna? The supinators and extensors.

What are the *supinators* and *extensors*? *Supinator radii longus*,[13] *extensor carpi radialis longior* and *brevior*, *extensor carpi ulnaris*, *extensor digitorum communis*, *supinator radii brevis*, *extensor ossis metacarpi pollicis manus*,[14] *extensor minor pollicis manus*, *major pollicis manus*, and *indicator*.

Inferior Extremity.

Thigh.

What are the *origin*, *insertion*, and *use* of the following muscles?

Tensor vaginæ femoris[4] (Fig. 28). Origin, ilium. Insertion, fascia lata.

Sartorius.[5] Origin, anterior superior spinous process of ilium. Insertion, upper end of tibia. Use, to bend the leg and draw it obliquely in.

Rectus femoris.[6] Origin, anterior inferior spinous process and margin of acetabulum. Insertion, patella.

Vastus externus.[7] Origin, below trochanter major and outer edge of linea aspera. Insertion, unites with rectus.

Vastus internus.[8] Origin, on a level with trochanter minor and from inner edge of linea aspera. Insertion, unites with rectus.

Cruræus. Origin, anterior and external part of femoris. Insertion, unites with rectus. Use of these four to extend the leg.

Fig. 27.

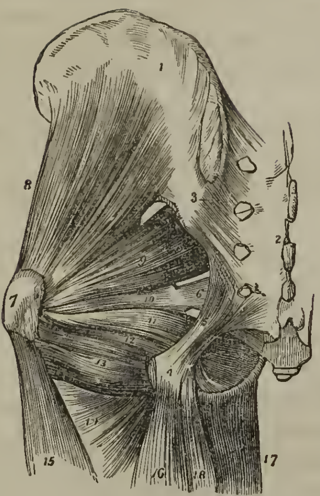


Fig. 28.

Gracilis.[15] Origin, symphysis and descending ramus of the pubis. Insertion, internal surface of tibia. Use, to flex the leg.

Pectineus.[12] Origin, horizontal portion of pubis. Insertion, upper part of linea aspera. Use, to draw the thigh inwards and forwards.

Adductor longus.[13] Origin, anterior surface of pubis. Insertion, middle third of linea aspera.

Adductor brevis. Origin, anterior inferior surface of pubis. Insertion, superior third of linea aspera.

Adductor magnus.[14] Origin, descending ramus of pubis, ramus and tuberosity of the ischium. Insertion, internal condyle and ridge leading to linea aspera. Use, these three muscles draw the thigh inwards.

Glutæus maximus.[9] Origin, posterior third of spine of ilium, sacrum, os coccygis, and sacro-sciatic ligament. Insertion, between trochanter and linea aspera, linea aspera and fascia lata. Use, to draw the thigh back and keep the trunk erect.

Glutæus medius.[3] Origin, spine of ilium and dorsum. Insertion, great trochanter. Use, to draw the thigh back and out.

Glutæus minimus. Origin, dorsum of ilium. Insertion, great trochanter. Use, to abduct the thigh and rotate the limb inwards.

Pyriformis[9] (Fig. 27). Origin, sacrum, sciatic ligament, and ilium. Insertion, root of trochanter major. Use, to rotate the limb in.

Gemini.[12] Origin, one from root of the spine of ischium, the other from tuberosity. Insertion, root of trochanter major. Use, to rotate the limb in.

Obturator internus.[11] Origin, pelvic margin of foramen thyroideum, its membrane and plane of the ischium. Insertion, fossa of trochanter. Use, to rotate the limb out.

Quadratus femoris.[13] Origin, tuber ischii. Insertion, great trochanter and line leading to the lesser. Use, to rotate the limb out.

Obturator externus. Origin, obturator ligament. Insertion, fossa at root of trochanter. Use, to rotate the thigh out.

Biceps flexor cruris.[16] Origin, long head, tuber ischii; short head, linea aspera low down. Insertion, head of fibula. Use, to flex the leg.

Semi-tendinosus.[18] Origin, tuber ischii. Insertion, tibia. Use, to flex the leg.

Semi-membranosus. Origin, tuber ischii. Insertion, external condyle of femur, and head of tibia and fibula. Use, to flex the leg.

Leg.

Tibialis anticus.[3] (Fig. 29). Origin, head and spine of tibia, interosseous ligament. Insertion, great cuneiform bone and first metatarsal. Use, to present the sole obliquely in.

Extensor longus digitorum pedis.[4] Origin, heads of tibia, fibula, and interosseous ligament. Insertion, last phalanx of the four external toes. Use, to extend the toes.

Peroneus tertius.[6] Origin, fibula. Insertion, metatarsal bone of little toe. Use, to bend the foot.

Fig. 29

Fig. 30

Extensor proprius pollicis pedis.[5] Origin, middle third of fibula and tibia. Insertion, second phalanx of great toe. Use, to extend it.

Peroneus longus.[7] Origin, head of fibula and tibia. Insertion, metatarsal bone of great toe and internal cuneiform. Use, to extend the foot and incline the sole outwards.

Peroneus brevis.[8] Origin, lower half of fibula. Insertion, base of metatarsal bone of little toe and cuboid bone.

Gastrocnemius.[10] Origin, upper and back part of condyle of femur and ridge above it. Insertion, os calcis.

Soleus.[9] Origin, external head from superior third of fibula; internal head, middle third of tibia, unites with the above and forms the tendo-Achillis. Insertion, os calcis. Use, to extend the foot.

Plantaris. Origin, back part of femur. Insertion, os calcis.

Popliteus.[6] Origin, depression on outer condyle. Insertion, upper part of tibia.

Flexor longus digitorum pedis perforans.[7] Origin, flat surface of tibia, fascia, &c. Insertion, last phalanx of four lesser toes.

Flexor longus pollicis pedis.[9] Origin, inferior part of fibula. Insertion, last phalanx of great toe.

Tibialus posticus.[8] Origin, tibia, fibula, and ligament. Insertion, os naviculare. Use, to extend the foot, and present the sole inwards.

Organs of Digestion.

What are the *organs of digestion?* The organs of digestion

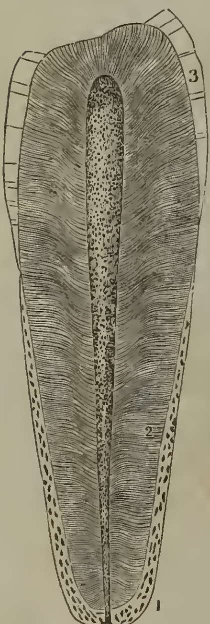
Fig. 31.

consist in an uninterrupted canal extending from the lips to the anus, and of numerous glandular bodies placed along its course. This canal, called alimentary, is divided into three portions, the *superior, middle,* and *inferior.* The *superior* is composed of the *mouth, pharynx,* and *œsophagus*;[1,2] the *middle,* of the *stomach*[3] and *small intestine*;[4,6,6,6] the *inferior,* of the *large intestine.*[9,10,11,12,13,14] The *glandular bodies* are the *salivary glands, pancreas, liver, spleen,* and a large number of *muciparous glands* extending along the whole course of the canal.

Teeth.

What are the *characteristics* of the teeth? They are the hardest portions of the body, and bear an analogy to bone. The greater part of their length is implanted into the alveolar processes of the jaws; this part is called the *root;* beyond this is a portion embraced by the gum called the *neck;* and the free or projecting part is the *body* or *corona.*

Fig. 32.



What is the *number* of teeth in the adult? Thirty-two; sixteen in each jaw, and are classified from their shape into eight incisors, four cuspated, eight bi-cuspated, and twelve molar.

Of what are teeth *composed?* They are composed of three substances, one of which is *ivory,* or *bone*-like, called *dentine*;[2] one is *enamel*;[3] and the other is called *crusta petrosa,* or *cementum.*[1] The enamel forms the periphery of the body of a tooth, as is known by its whiteness, brittleness, semi-transparency and hardness. It is fibrous, and the fibres are placed so as to pass from the surface towards the centre of the tooth, so that the friction is applied against their extremities. Its composition is principally phosphate of lime with a small portion of gelatin. The osseous portion is the most abundant; it forms the root, neck, and body, except the crust of enamel on its periphery.

The cement covers all the surface of the tooth that is not invested with enamel. Internally there is a cavity,[4] filled with a soft pulpy matter, which receives an artery, a vein, and a nerve.

The *arteries* of the teeth of the upper jaw come from the alveolar and infra-orbitar, and the *nerves* from the second branch of the fifth pair; the arteries of the lower teeth come from the internal maxillary, and the nerves from the third branch of the fifth pair.

What is understood by the *deciduous teeth?* They are teeth peculiar to infants, and are twenty in number, ten in each jaw; on either side are two incisors, one cuspidatus, and two molares. Some of them fall out about the seventh year, and all of them by the fourteenth. The order of their appearance is as follows: —

Two central incisors, from the sixth to the eighth month.

Two lateral incisors, from the seventh to the tenth month.

The first molar on each side, from the twelfth to the fourteenth month.

The cuspated, from the fifteenth to the twentieth month.

The second molar, from the twentieth to the thirtieth month.

At birth there are the rudiments of fifty-two teeth in the two jaws; twenty deciduous and thirty-two permanent.

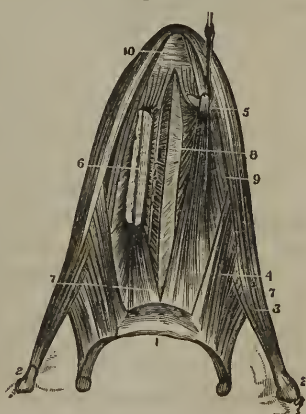
How are the deciduous teeth removed? By the absorption of the roots.

Tongue.

Where is the tongue situated? It extends from the os hyoides posteriorly to the incisor teeth anteriorly. It is divided into base, body, and tip.

What *muscles* compose the tongue? The *styloglossus,*[3] *hyoglossus,*[4] *genio-hyoglossus,*[5, 6, 7] and *lingualis*[9] form the principal bulk; besides these there are the *superficial lingual muscle, transverse lingual muscles,*[10] and the *vertical lingual muscles*, which are small fibres running in different directions, as their names indicate.

Fig. 33.



How are the *papillæ* of the tongue divided? Into *papillæ maximæ* or *capitatæ*, *mediæ*, *villosæ*, and *filiformes;* and occupy the anterior two-thirds of this organ.

What other parts are there to remark about the tongue? The *fræna-epiglottidis*, *frænum linguæ*, *foramen cæcum*, and *raphé.*

The tongue is supplied with arteries principally from the lingual branch of the carotid; and with nerves from the hypoglossal, the fifth pair, and the glosso-pharyngeal.

Palate.

What *composes* the palate? It is composed anteriorly by the palatine processes of the superior maxillary and palatine bones, covered by the lining membrane of the mouth below, and pituitary membrane above; posteriorly is a membranous portion called the *soft palate*, which has an oblong shape and continued from the hard palate posteriorly; in its centre is the *uvula*, from which proceed the two crescentic doublings called the *lateral half arches*, which are divided into anterior and posterior. In the depression between these is the *tonsil gland*. The space bounded in front and behind by these lateral half arches, is the *fauces;* and the anterior opening into it is the *isthmus of the fauces.*

The muscles of the palate are the *isthmi constrictor faucium*, *palato-pharyngeus*, *circumflexus*, or *tensor palati*, *levator palati*, and *azygos uvulæ.*

Glands.

How are the glands of the mouth divided? Into *muciparous* and *salivary.*

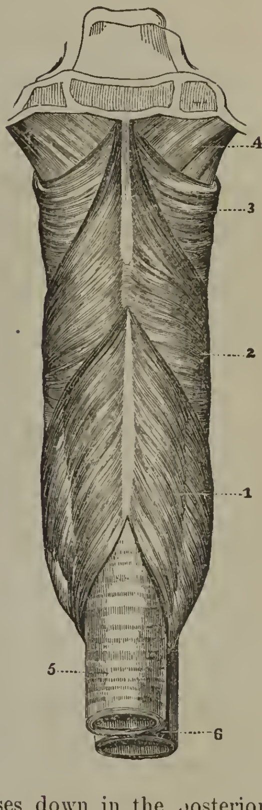
What are the *muciparous* glands? They are the *labial*, *buccal*, *lingual*, *palatine*, and the *tonsils*. The buccal, labial, and palatine are, properly speaking, salivary glands.

What are the *salivary glands*? The *parotid*, its excretory duct is called the *duct of Steno;* it is the size of a crow quill, and opens opposite to the second large molar tooth of the upper jaw; the *submaxillary*, its duct is called the *duct of Wharton;* and the *sublingual*, its duct is called *ductus Riviniani.*

Pharynx.

What are the *characteristics* of the pharynx? It is a large membranous cavity, situated between the cervical vertebræ and posterior part of the nose and mouth, and extends from the base of the cranium to the lower part of the cricoid cartilage and fifth cervical vertebra, where it is continued into the œsophagus; it has seven foramina opening into it, viz.: posterior nares, two; Eustachian tubes, two; mouth, larynx, and œsophagus. It consists of *three coats;* the *external* or *muscular* is composed of three muscles on each side, one above the other — a *cellular*, *intermediate*, and an *internal*, or *mucous* coat. The muscles forming the muscular coat are the *constrictors inferior*,[1] *medius*, and *superior*.[3] The arteries which supply it are the superior and inferior pharyngeal on each side.

Fig. 34.

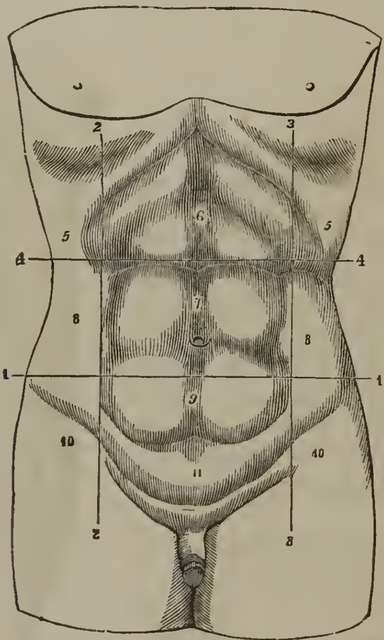


What are the *characteristics* of the *Œsophagus*[2] (Figs. 31 and 37)? It is a tube continuous with the pharynx, in front of the spine, behind the trachea, ten or twelve lines in diameter, increases in size from above downwards, and terminates at the cardiac orifice of the stomach, at a point opposite the tenth dorsal vertebra. In the thorax, it passes down in the posterior mediastinum, with the aorta on the left, and the vena azygos on the right. It has three coats, the *muscular*, *cellular*, and *mucous*, and is united to adjacent parts by loose cellular substance. The muscular coat consists of two laminæ, the longitudinal and the circular. Its arteries are derived from the inferior thyroid, the thoracic aorta, and the gastric.

Abdomen.

How is the abdomen *bounded?* Inferiorly by the iliaci interni, the psoæ, and levator ani muscles; on the front and sides by the

Fig. 35.



five pairs of abdominal muscles; posteriorly by the lesser muscles of the diaphragm, quadrati lumborum, the lumbar vertebræ, and the sacrum.

How many *kinds of viscera* are contained in the cavity of the abdomen? Three: one is engaged in digestion and assimilation, another in the secretion and excretion of urine, and the third in generation.

How is the abdomen *divided?* Into arbitrary regions: consider a line or plane as extending across the abdomen about two inches below the umbilicus from the superior part of the crista of one ilium

to the corresponding point of the other side.[1,1] Draw on each side a line perpendicular to the first by commencing at the anterior inferior spinous process of the ilium, and carry it up to the diaphragm:[2 3] then extend a fourth line across the abdomen parallel with the first, and intersecting the two last where they strike the cartilages of the ribs.[4,4] It is seen that these four lines or planes, with the assistance of the parietes of the abdomen, furnish *nine regions*. The central one above is called the *epigastric*,[6] and the lateral the *right* and *left hypochondriac*.[5,5] The *central* in the middle is the *umbilical*,[7] and the lateral the *right*[8] and *left*[8] *lumbar*. The central below is the *hypogastric*,[9] and the lateral the *right*[10] and *left*[10] *iliac*. The *scrobiculus cordis*, or pit of the stomach, is the hollow in the epigastric region. The *regio pubis*[11] is the region for two inches around the symphysis pubis. These two last are termed subordinate divisions.

What position relative to these regions does the *liver* occupy? Nearly the whole of the right hypochondriac, the upper half of the epigastric, and the right superior part of the left hypochondriac.

Where is the *spleen* situated? In the posterior part of the left hypochondriac region.

Where is the *stomach*[2] (Fig. 36) situated? Moderately distended, it occupies the lower half of the epigastric region and the right inferior portion of the left hypochondriac.

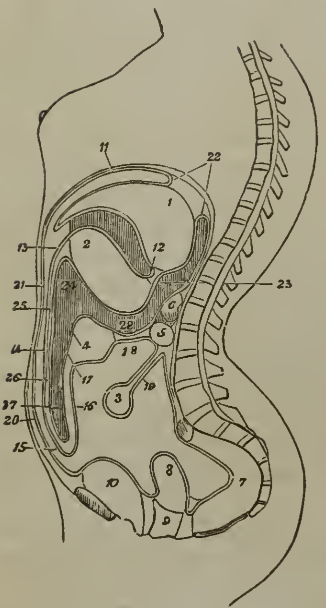
Where is the *small intestine*[3] situated? Moderately distended by flatus, it occupies the umbilical region, the hypogastric, portions of the iliac on each side, and also the upper part of the cavity of the pelvis, when its viscera are empty.

Where is the *large intestine*[4] situated? It begins in the right iliac region, ascends through the right lumbar and right hypochondriac, passes into the lower part of the epigastric, or upper part of the umbilical, according to the state of distension of the stomach, thence into the left hypochondriac, left lumbar, and left iliac, passes into the pelvis, and descending in front of the sacrum, terminates in the anus.

Where is the *pancreas*[6] situated? Transversely in the lower back part of the epigastric region, extending from the left hypochondriac to the right side of the spine, and is placed behind the stomach, which covers it.

Where are the *kidneys* and *capsulæ renales* situated? In the posterior part of the lumbar regions on each side of the spine.

Fig. 36.



Where are the *urinary bladder*[10] and *rectum*[7] situated? In the cavity of the pelvis, and between them in the female are the uterus, ovaries, and vagina.

What is understood by the *peritoneum*? It is a serous membrane lining the abdomen and reflected over the periphery of nearly all the viscera. It is a complete sac, with no opening into it, except in the female through the Fallopian tubes.

What are the *processes* of the peritoneum? There are four, and are known by the general name of *omentum, epiploon*, or *caul.* They are called *omentum minus*, or *hepatico-gastricum*,[12] *omentum majus* or *gastro-colicum*,[13, 14, 1, 1] *omentum colicum*,[18] and the *omentum gastro-splenicum*, besides some other smaller reflections.

What are the characteristics of *serous membranes*? They are thin, transparent, and white, resemble compressed cellular membrane, invariably assume the form of perfect sacs, are distinct one from another, and secrete a serous fluid for the lubrication of their internal surfaces.

Chylopoietic Viscera.

Stomach.

What are the *characteristics* of the stomach? It is a hollow viscus, situated in the epigastric region, of a conoidal shape, curved upwards, and presents *two faces, two orifices, two curvatures*, and *two extremities.* The faces are called *anterior* and *posterior.*

4 coats – peritoneal muscular cellular mucous

Fig. 37.

The orifices are named *cardiac* and *pyloric*. The curvatures are the *small*[3] and *great*, or *upper* and *lower*. It has four coats or laminæ, viz: *peritoneal*, *muscular*, *cellular*, and *mucous*. Its muscular coat is collected into fasciculi, and pass in three directions, longitudinal, circular, and oblique. The *glands of Brunner* are situated near the cardiac and pyloric orifices. It is very vascular; its arteries being branches of the cœliac, are the gastric, right and left gastro-epiploic, and the vasa brevia. The first to the lesser curvature; the second and third along the great curvature; and the last, from four to six in number, to its great cul-de-sac. The veins terminate in the vena portarum. Its nerves come from the par vagum and the semilunar ganglion of the sympathetic.

Intestines.

What is the length of the intestinal canal from the pylorus to the anus? From thirty to thirty-five feet; and is divided by anatomists into the *small* and the *large intestine.*

What are the *characteristics* of the *Small Intestine?*[4,6,6,6] It commences at the pylorus, and terminates in the right iliac region by a lateral aperture in the large intestine. It is four-fifths of the length of the whole canal, being from twenty-four to twenty-eight feet, cylindrical; the upper end is larger than the lower, decreasing gradually as you proceed downwards. It has four coats like the stomach, which have the same names. The course of its muscular fibres is longitudinal and circular. Its mucous coat is thrown into folds or duplicatures, called *valvulæ conniventes,* in the direction of the circumference, and are segments of circles.

On this coat are numerous small projections, called *villi;* hence it is sometimes termed villous coat. Each villus is composed of an artery, vein, and lymphatic, or lacteal. Its mucous glands are situated in the cellular coat, between the muscular and mucous, and their ducts open on the surface of the latter. They are *solitary* and *aggregated;* the former are *glandulæ solitariæ* or *Brunneri,* and are found principally in the duodenum, and upper portion of the small intestine; the latter are called *glandulæ agminatæ* or *Peyeri,* and exist in the lower part of the small intestine.

How is the small intestine *divided?* Into *duodenum,*[4] *jejunum,*[6] and *ileum;*[6] the latter two have no mark of distinction, and are sometimes called the mesenteric portion. The duodenum is about twelve inches long, and is the commencement of this canal. The upper two-fifths below the duodenum is called the jejunum, and the lower three-fifths the ileum.

What is the *Mesentery?* It is the process of peritoneum which serves to connect the small intestines to the posterior parietes of the abdomen, and extends from the left side of the second lumbar vertebra to the right iliac fossa; this attachment is called the root, and is about six inches long. Its laminæ contain the superior mesenteric artery and vein, lymphatic or lacteal glands and vessels, ramifications from the solar plexus of the sympathetic nerves, and cellular and adipose tissue.

What are the *characteristics* of the *Large Intestine?* It exceeds in diameter the small, and receives the effete matter therefrom. It is not so regularly cylindrical; the surface is arranged into three series or longitudinal rows of projections, separated by transverse depressions. It commences at the inferior end of the small intestine, and terminates at the anus. It is divided into three parts; the commencement, below the insertion of the ileum, about two inches in length, is called the *cœcum*,[7] or *caput coli;* the remaining portion, until it reaches the pelvis, is called the *colon*,[9, 10, 11] when it takes the name of *rectum.*[13] The appendix vermiformis[8] is a worm-like process attached to the inferior portion of the cœcum.

What is meant by *Mesocolon?* A duplication of peritoneum, which fixes the large intestine to the posterior parietes of the abdomen.

How many coats has the large intestine? Four, bearing the same name as those of the small intestine. The *peritoneal* coat has small duplicatures containing fat, and called *appendices epiploicæ;* the *muscular* coat has two layers of fibres, the longitudinal, and transverse or circular; the *mucous* coat has but few villi, but its muciparous glands and follicles are very numerous.

Where is the *ileo-colic valve?* At the junction of the ileum and caput coli or cœcum.

What is meant by *Mesorectum?* It is that duplicature of peritoneum which attaches the rectum to the sacrum.

From what is the large intestine supplied with blood? A part of the superior mesenteric, the whole of the inferior mesenteric, and the internal pudic arteries; the veins empty into the vena portarum; the nerves are derived from the solar and hypogastric *plexus* of the sympathetic.

What are the *characteristics* of *mucous membranes?* They line the internal surfaces of the hollow viscera, and form an internal tegument to the body, analogous to the skin. They are of a soft, spongy consistence, easily yield to mechanical violence, and are dependent upon the surrounding cellular coat for their strength.

Assistant Chylopoietic Viscera.

What are the *characteristics* of the *Liver?* It secretes the bile, and is the largest gland in the human body. Its whole superior face is in contact with the diaphragm; on the left is the spleen, below are the stomach and transverse colon, and behind are the vertebræ and ascending cava. It is about ten inches in length, six or seven wide, and weighs in the adult four to five pounds. It is divided into *lobes*, called *right* and *left*. The former is the larger, and has elevations on its surface, called *lobulus spigelii*, and *lobulus quartus*. On the under surface are five fissures, viz: *longitudinal*, *of the ductus venosus*, *transverse*, one *for the gall-bladder*, and one *for the vena cava*.

What are the *ligaments* of the liver? The *falciform* or *suspensory*, the *ligamentum teres*, the *right lateral*, the *left lateral*, and some anatomists give the name of *coronary* to that duplicature of peritoneum, at the junction of the suspensory and lateral ligaments. The liver has also a proper coat connecting it with the peritoneum.

What are the *bloodvessels?* They are of three kinds: the vena portarum, the hepatic artery, and the hepatic veins.

What *composes* it? Acini, or granulations, each of which is complete in itself, having the above-named bloodvessels, the origin of a branch of the hepatic duct, called porus biliarius, lymphatic vessels, and nerves.

What is the *capsule* of *Glisson?* It is a condensed lamina formed out of a white and yellow elastic cellular fibrous tissue, at the bottom of the transverse fissure of the liver, which invests the vena portarum, hepatic artery, and biliary ducts, and follows them throughout the substance of the liver.

What are the *characteristics* of the *Gall-bladder?* It is a reservoir for the bile, fixed on the under surface of the great lobe of the liver, to the right of the umbilical fissure; its shape is an oblong pyriform sac, and is about three inches in length. It has three coats, a peritoneal, a cellular, and a mucous. Its artery is a branch of the hepatic; its veins empty into the vena portarum, and its nerves come from the sympathetic. Its duct, called *cystic*, unites at an acute angle with the hepatic duct, and forms the

ductus communis choledochus; these ducts have two coats: an external, fibrous, lamellated, and extensible; and a mucous.

What are the *characteristics* of the *Spleen?* It is in the posterior part of the left hypochondriac region, bounded above by the diaphragm, below by the colon, on the right by the great end of the stomach, and the pancreas. Its color varies from deep blue to dark brown; it is usually about four and a half inches long by two and a half wide. Its artery, called splenic, is a branch of the cœliac, its vein empties into the vena portarum; the lymphatics are numerous and remarkably large, and its nerves are derived from the solar plexus. It has no excretory duct, and its use is not ascertained; but it most probably serves as a diverticulum in case of congestion.

What are the *characteristics* of the *Pancreas?* It is fixed in the lower and back part of the epigastric region, bounded in front by the stomach which conceals it, and is between the two laminæ of the mesocolon, about six or seven inches long, two wide, and flattened before and behind; its right extremity is enlarged into a head or tuber, sometimes called the *lesser pancreas.* It is of a light gray, or pink color, and consists of lobules. The arteries which supply it come principally from the splenic; the veins empty into the splenic; and the nerves come from the solar plexus. It secretes a salivary fluid, and is the largest of this class of glands. Its excretory duct is called *ductus Wirsungii,* which either penetrates the ductus communis choledochus, or the duodenum, very close to it.

Urinary Organs.

What are the urinary organs? The *kidneys, renal capsules, bladder, ureters,* and *urethra.*

What are the *characteristics* of the *Kidneys?* They are two glandular bodies for the secretion of urine, situated on either side of the spine, extending from the upper margin of the eleventh dorsal to the lower margin of the second lumbar vertebra; the right is ten or twelve lines lower than the left; they are hard, solid, of a brown color, a compressed ovoidal shape, excavated on the margin, which is applied to the spine, and resemble the common kidney bean; they are about four inches long, and two wide, and weigh each three or four ounces, have no peritoneal coat, but have

a well marked capsule; the arteries are called the renal or emulgent, and are branches of the aorta; the veins take the same name as the arteries, and are equal to them in number. The substance of the kidneys is divided into cortical[2] (Fig. 38), and medullary or tubular.[3]

The cortical, or secretory substance forms the circumference, and is on an average about two lines in thickness. It consists of a number of tortuous tubes of Ferrein, in which the urine is first formed.

The tubular portion consists in from twelve to eighteen conoidal fasciculi called the *medullary cones* of *Malpighi*,[3] with their bases towards the cortical portion; their apices converge towards the centre, are free, and project so as to form the *papillæ renales*.[3] Each fasciculus or cone is capable of subdivision into small *pyramids of Ferrein*, and each pyramid consists of a number of straight *tubes of Bellini* or *tubuli uriniferi*, into which the *tortuous tubes of Ferrein* empty. The apex of each cone is called *papilla renales*, and in the centre of each papilla is a slight depression called *foveola;* it is received into the infundibulum, into which the urine is carried as it oozes from the orifices of the papilla.

What composes the *excretory duct* of the kidney? The *ureter*,[7] which commences in the centre of the kidney, by an enlargement called *pelvis;*[6] this branches off superiorly into three or four portions called *calices*,[4] one above, one below, and one or two intermediate. Each of these calices is divided at its free extremity into three or four short funnel-shaped terminations, called *infundibula*.[5] These terminations embrace, each by its expanded orifice, the base of a papilla, so as to permit the latter to project into it, and distil its urine there. The pelvis of the kidney as it emerges from the fissure becomes reduced to a cylindrical canal, which is properly the *ureter;*[7] it is about the size of a goose quill, descends into the pelvis, and penetrates obliquely the coats of the bladder, ten or twelve lines behind its neck[3] (Fig. 39), and is composed of two coats or laminæ.

Fig. 38.

What are the *Renal capsules*[1] (Fig. 38)? They are two small bodies, one on either side, placed upon the upper end of the kidney, of a yellowish-brown color tinged with red, have no excretory ducts, and are the most distinctly developed in the fœtus. The arteries are derived from the aorta, the renal, and phrenic arteries; the vein of the right side empties into the vena cava; that on the left side into the renal vein. The nerves are supplied from the renal and phrenic plexuses.

What are the *characteristics* of the *Bladder* (Fig. 39)? It is the reservoir for the urine, placed in the pelvis just behind the symphysis of the pubes. The superior end is called the *upper fundus;*[5] the lower end the *inferior fundus;*[6] and between the two is the *body;* the *neck* is its place of junction with the urethra. It consists of four coats, the *peritoneal*, *muscular*, *cellular*, and *mucous;* and is retained in its place by *seven true* ligaments, viz: *two anterior*, *two lateral*, *two umbilical*, and the *urachus;* and by *four false*, viz: *two anterior*, and *two posterior*.

The first four are formed by the pelvic fascia; the two umbilical by the obliteration of the umbilical arteries of the fœtus; and the false ligaments are reflections of the peritoneum The internal face of the mucous coat presents at its inferior part the *vesicle triangle*,[3,3,4] with its smooth centre[7] behind and below the neck, occupying the space between it and the orifices of the ureters. The *uvula vesicæ*[4] is at the anterior angle of the triangle, which sometimes presents an obstruction to the introduction of the catheter.

Organs of Generation in the Male.

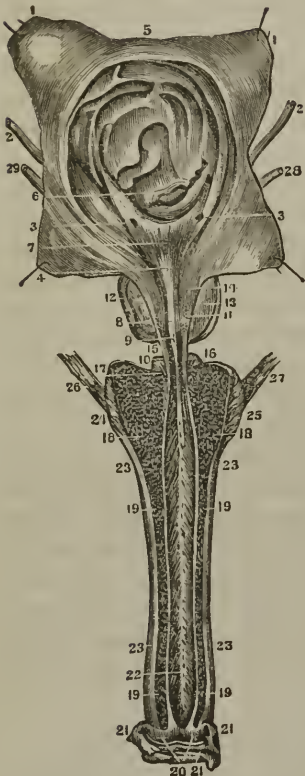
What do the male organs of generation consist of? The *testicles*, and the *penis*, with their *appendages*.

How is the *Penis* formed? By common integuments, cellular tissue, the corpora cavernosa, and the corpus spongiosum urethræ.

What are the *characteristics* of the *Urethra?* It is a canal whose length varies, and extends from the neck of the bladder to the extremity of the glans penis. The first part penetrates the *prostate gland*,[13] and is called the *prostatic portion;*[14] on its inferior surface is a doubling, which constitutes the *verumontanum*[8] or *caput gallinaginis.*[8] Between the prostate and the *bulb*[18] is the *membranous portion*,[15] about eight or ten lines long; the

balance of the urethra is lodged in the corpus spongiosum from its commencement at the deep perineal fascia to the meatus urinarius; this canal varies in its dimensions in different parts.

Fig. 39.



What other parts are to be observed in Fig. 39? The *ureters,*[2] *orifice of the ductus ejaculatoris,*[9] *ducts*[11] *from the prostate gland,* with the *neck of the bladder above,* one of *Cowper's glands,*[16] with the *orifices* of their *excretory ducts,*[17] *corpora cavernosa,*[19] *erector penis muscle,*[26, 27] *accelerator urinæ muscle,*[24, 25] and *prostate gland.*[12, 13]

What are the *characteristics* of the *Vesiculæ seminales*? They are two convoluted tubes, one on each side, two inches in length, placed on the lower fundus of the bladder, between it and the rectum, and behind the prostate gland; they are composed of two coats. The excretory duct of each vesicle is about a line and a half long, when it joins with the vas deferens of the same side; a common canal is formed called *ductus ejaculatorius,* which is eight or ten lines long, runs parallel with its fellow, and opens at the lateral anterior face of the caput gallinaginis.

What are the *characteristics* of the *Prostate gland,*[12, 13] (Fig. 39)? It is a body about the size of a horse-chestnut, fixed on the neck of the bladder, and penetrated by the urethra. Its secretion is emptied into the prostatic portion of the urethra by fifteen or twenty excretory ducts.

What is the situation of Cowper's glands? They are two in number, one on each side, situated in advance of the prostate, between the laminæ of the triangular ligament.

What are the *characteristics* of the *Testicles?* They are two in number, one on each side of the scrotum, of an oblong form, compressed laterally, an inch and a half long, one inch in breadth, eight or ten lines in thickness, and enveloped by the *scrotum, dartos, tunica vaginalis, tunica albuginea,* and *tunica vasculosa.*

The *scrotum* is a continuation of the common skin, common to both testicles, symmetrical, and divided by a middle line called *raphé.*

The *dartos* is within the scrotum, and forms two sacs, one for each testicle.

The *tunica vaginalis* is rigidly comparable to a double night-cap, one portion adhering firmly to the tunica albuginea beneath, and the other loosely reflected over the testicle.

The *tunica albuginea*[1] is the proper coat of the testicle, and is in immediate contact with it; it is dense, strong, white, and fibrous.

The *tunica vasculosa* is the nutrient membrane of the testis; situated immediately within the albuginea, enclosing the substance of the gland, and sending processes inwards between the lobules.

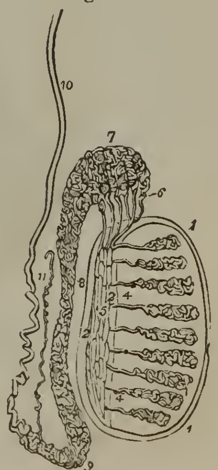
The *glandular portion* of the testicles consists of a congeries of convoluted tubes called *tubuli seminiferi,*[3,3] amounting to three hundred in number, and each nearly seventeen and a half feet in length, forming hanks held together by cellular substance.

The *vasa recta*[4] are terminations of the tubuli seminiferi, which unite near the centre of the testicle, in a complicated arrangement, called rete vasculosum[5] testis.

The *vasa efferentia*[6] (from twelve to eighteen ducts) proceed from the *rete vasculosum testis,*[5] and penetrate the *corpus Highmorianum,*[2,2] and tunica albuginea. Each one is then convoluted upon itself into a conical body, the *conus vasculosus.*[7] Each cone, at its base, has its tube entering successively into the tube of which the epididymis is formed.

The *epididymis*[8] is formed of a single convoluted tube of the fourth of a line in diameter; at the lower end it becomes less convoluted, turns upwards, and obtains the name of *vas deferens.*[10]

Fig. 40.



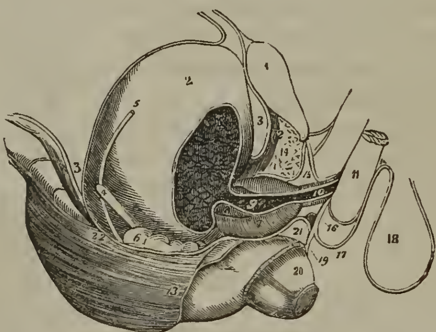
What forms the *Spermatic cord?* It is a fasciculus of about half an inch in diameter, and may be felt passing from the upper end of the testicle to the abdominal ring. It is formed by the vas deferens, spermatic artery, and veins, lymphatics of the testicle, and the nerves; covered by a cellular substance called tunica vaginalis communis, and the cremaster muscle.

The Cremaster muscle is derived from the internal oblique and transversalis, completely envelops the cord, and draws the testicle upwards. The *vas deferens*[10] is the proper excretory duct of the testicle; it is a white tube, about a line and a half in diameter, and has a cartilaginous feel; from the internal abdominal ring, it dips down into the pelvis by the side of the bladder, and terminates in the urethra, after uniting with the duct from the vesicula seminalis; this common duct is called the *ductus ejaculatorius.*

What is understood by the *Perineum?* The space included between the anus, arch of the pubis, and the tuberosities of the ischia.

What are the fasciæ and muscles of the perineum? Perineal fascia,[17] the triangular ligament of the urethra,[15] and the pelvic fascia.[13] The perineal fascia[17] is beneath the superficial fascia, and

Fig. 41.



is dense, thin, and tough; in front it is continuous with the dartos,[18] behind with the base of the triangular ligament[15] by its anterior lamina,[16] also with the anal fascia,[19] a portion of the pelvic fascia.[13] Beneath this the muscles of the perineum are situated.

The triangular ligament[15] occupies the arch of the pubis; the shape is indicated by the name. It is perforated by the membranous portion of the urethra about an inch below the symphysis, and separates the pelvis from the perineum; it joins the perineal and anal fasciæ.[21] Cowper's[16] and the prostate gland[7] is situated between its two laminæ,[16,21] the posterior of which is usually called the fascia of the prostate.

What other parts are exhibited by Fig. 41? The *bladder*,[2] the *ureter*,[4] *vas deferens*,[5] *right vesicula seminalis*,[6] *recto-vesical fold of the peritoneum*,[3] *prostate gland*,[7] *neck of the bladder*,[8] *prostatic portion*[9] of the *urethra*, *membranous portion*,[10] *deep fascia*,[22,19] *levator ani*.[20]

The pelvic fascia surrounds that portion of the peritoneum which lines the pelvis, and is continuous with the transversalis and iliac fasciæ. The anterior ligaments of the bladder[12] (Fig. 41), obturator fascia, and recto-vesical fascia, are processes of this. The muscles are the erector penis, accelerator urinæ, transversus perinei, sphincter ani, coccygeus, and levator ani. (See Figs. 19 and 39.)

Female Organs of Generation.

What are the organs of generation in the female? The vulva, vagina, uterus, Fallopian tubes, and the ovaria.

What constitutes the *Vulva*? The vulva consists in the mons veneris, the labia externa, the labia interna, or nymphæ, the clitoris, the vestibulum, the orificium urethræ, the fourchette, and the fossa navicularis. These are called the external organs.

Where is the *Mons Veneris* and the other external organs situated? The mons veneris is an accumulation of cellular and adipose substance covering the pubes.

The *Labia Externa* are two bodies of a similar texture to the mons veneris, running parallel from it in a downward and backward course, where they unite and form the posterior commissure, or fourchette.

The *Clitoris* is directly beneath the superior union, or origin of the labia; it consists of two crura which unite and form its body, the external termination of which has been called its glans.

The *Nymphæ*, or *Labia Interna*, are two similar bodies depending from the clitoris, which separate and run downwards towards the os externum.

The *Vestibulum* is a depression twelve or fifteen lines long, between the labia interna. It is bounded above by the clitoris and below by the orifice of the urethra.

The *Orifice* of the *urethra* is found between the inferior portions of the nymphæ, at the inferior part of the vestibulum. The canal of the urethra is about $1\frac{1}{2}$ inches in length.

The *Orifice* of the *vagina* is below the orifice of the urethra, and immediately under the symphysis pubis.

The *Hymen* is a membranous expansion at the orifice of the vagina, and partially closing it.

The *Carunculæ myrtiformes* are small fleshy vascular bodies situated at the external orifice of the vagina, upon which in the virgin state the hymen appears to spread itself.

The *Fourchette* is a semilunar fold in advance of the hymen.

The *Fossa navicularis* is the space below the vestibulum and fourchette, and anterior to the orifice of the vagina.

The *Perineum* is the space directly behind the inferior termination of the labia and before the anus, about an inch and a half in width.

What are the internal organs? The vagina, uterus, and uterine appendages.

What are the *characteristics* of the *Vagina?* It is a thin musculo-membranous canal, leading from the vulva to the uterus, from four to six inches in length, between the bladder in front and the rectum behind, flattened, so as to bring its anterior and posterior surfaces in contact, has three tunics, an external cellular, a middle muscular, and an internal mucous. At its anterior end is the *corpus spongiosum vaginæ*, or *plexus retiformis*. The *sphincter vaginæ* muscle surrounds its anterior orifice.

The *Hymen* is placed at the anterior orifice, for the purpose of closing it more or less perfectly.

What are the *characteristics* of the *Uterus?* It is a compressed pyriform body, two and a half inches long, and one and a half in diameter at its widest part. Its posterior face convex, anterior nearly flat, about one inch in thickness, and divided into fundus body, and neck. The *fundus* is the part between the Fallopian tubes at the superior extremity, the *neck* is the lower cylindrical portion, and the *body* is the part intermediate to the two. Its *cavity* is triangular, with the sides convex, and the inferior angle

presents towards the opening into the vagina called *os tincæ.* The mucous glands or lacunæ in the neck are called *ovula Nabothi.* It has three coats, a serous or external, a middle which is muscular, and an internal or mucous. The muscular coat is composed of longitudinal, circular, and oblique fibres. This organ is supplied with blood by the uterine and spermatic arteries; with nerves from the aortic plexus, and from the hypogastric nerves and plexus, being a mixture of sacral and sympathetic nerves.

What are the *Ligaments of the uterus?* The *broad* or *lateral*, the *anterior*, the *posterior*, and *round* ligaments.

What are the *Fallopian tubes?* They are two musculo-membranous canals, one on either side, in the superior part of the broad ligaments of the uterus, four inches long, extending from the upper angle of the uterine cavity to the side of the pelvis, where their extremities are loose, and expanded into a trumpet-shaped mouth, called their *fimbriated extremities*, They serve to conduct the ovum from the ovaries to the uterus.

What are the *characteristics* of the *Ovaries?* They are two in number, one on either side, situated on the posterior face of the broad ligaments, of a compressed ovoid shape, about half the size of the male testicle. They have two coats: a *peritoneal*, and the *tunica albuginea*, which corresponds with the same coat of the testicle. Their arteries are the spermatics; and their nerves are from the spermatic plexus. The proper tissue of the ovary (called its *stroma*) consists of dense cellular substance containing within its areolæ a number of small vesicles called *Graafian*, one of which is matured and thrown off at every menstrual period in a state of health, leaving behind a corpus luteum.

From whence do the female organs of generation derive their bloodvessels and nerves? Principally from the internal pudic and other branches of the hypogastric arteries; their veins run into the hypogastric; and their nerves come from the sacral and hypogastric plexuses.

Organs of Respiration.

What are the organs of respiration? The *larynx*, *trachea*, and *lungs*.

Larynx.

What are the *characteristics* of the larynx[12] (Fig. 42)? It is an irregular cartilaginous tube, forming the upper part of the wind-pipe; it is below the os hyoides and root of the tongue, bounded behind by the pharynx, and laterally by the primitive carotid arteries and internal jugular veins, and contributes essentially to the formation of the voice.

Five distinct cartilages enter into its structure; they are one *thyroid*, one *cricoid*, one *epiglottis*, and two *arytenoid*.

The *thyroid* is the largest, and forms the prominence in the upper part of the neck, called *pomum Adami*. It has two processes on each side; one called *cornu majus*, and the other *cornu minus*.

The *cricoid* is below the thyroid, forms the base of the larynx, and articulates with the trachea. Its form is that of a thick ring compressed laterally, and is three times as high posteriorly as it is anteriorly.

The *arytenoid cartilages* resemble triangular pyramids curved backwards, are about six lines long, and are placed on the upper margin of the cricoid cartilage behind.

The *epiglottis* is situated on the posterior face of the base of the os hyoides; its general shape is that of an oval disk.

The *ligaments* of the larynx are the *crico-thyroid*, the *middle thyreo-hyoid*, the *lateral thyreo-hyoid*, and the *thyreo-arytenoid*, two in number, on each side of the larynx, one above the other, three lines apart. These last-named ligaments also have the name of *ligamentum vocale;* and the portion of the larynx which is formed by them, and the pouches between them which are called the *ventricles* of *Galen*, are the structures essential to the formation of voice. The opening between the two lower ligaments is called the *rima glottidis;* and the space between the upper ligaments and the duplicature passing from the arytenoid to the epiglottis, is called *glottis*.

The *muscles* of the larynx are the *thyreo-hyoideus, crico-thyroideus, crico-arytenoideus posticus*, and *lateralis, thyreo-arytenoideus, arytenoideus-obliquus*, and *transversus, thyreo-epiglottideus*, and *aryteno-epiglottideus*.

The *nerves* of the larynx come principally from the superior and inferior laryngeal branches of the par vagum. The arteries are branches of the superior and inferior thyroid.

Trachea.

What are the *characteristics* of the trachea ?[11] It is a cylindrical canal four or five inches long, and nine lines in diameter; it opens into the larynx above, and terminates in the thorax opposite to the third dorsal vertebra, by two branches called bronchiæ. The structures which enter into the composition of the trachea are cartilage, ligamentous fibre, muscle, glands, and mucous membrane.

The cartilage preserves the shape, and consists of from sixteen to twenty distinct rings, which are deficient at their posterior third.

The ligamentous structure exists between the proximate margins of the rings, and fills up the intervals between them so as to render the tube perfect. The deficiency in the rings posteriorly is supplied in part by condensed cellular substance.

The muscular structure exists at the cartilaginous deficiency in the posterior third; the fibres pass in a transverse direction between the interrupted extremities of the rings; it is between the condensed cellular substance and the mucous membrane of the trachea.

The mucous membrane lines the whole internal portion, from the larynx to the bronchiæ, throughout all their ramifications.

The bronchi have the same structure and arrangement as the trachea; after ramifying into a number of subdivisions, they terminate in the lobules of the lungs.

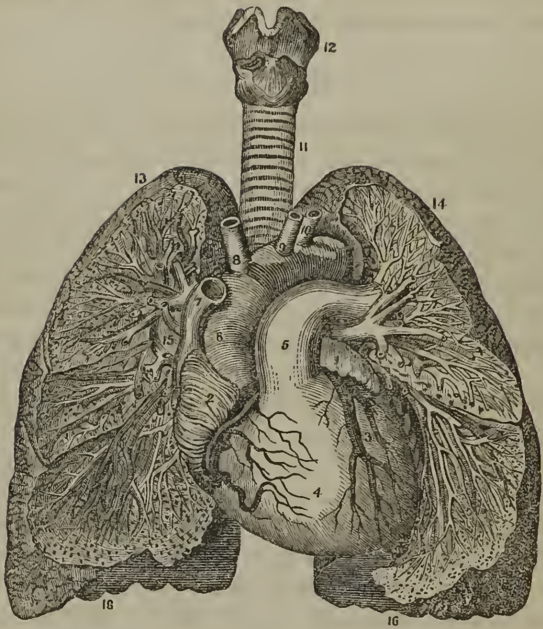
Where is the *Thyroid Gland* situated? It is placed on the first and second rings of the trachea, and on the sides of the larynx united in the centre by its *isthmus*.

Where is the *Thymus Gland* situated? Between the trachea and upper extremity of the sternum.

Lungs.

What are the *characteristics* of the lungs ?[13,14,16] They are essentially the seat of the process of respiration, and occupy nearly the whole cavity of the thorax. They are two bodies of a grayish-

Fig. 42.



ık color, separated by the heart and its great vessels, and each forms an irregular cone with the apex above.

The right lung is divided into three *lobes*, and the left into two. Each lobe is divided into distinct *lobules*, united by cellular tissue. The lobules are subdivided into fine air-cells; these cells communicate laterally in the individual lobules, but not with the cells of different lobules. These air-vesicles are united together by cellular tissue, forming the parenchyma through which blood and air-vessels ramify. Each lobule has a ramification of the bronchial tube sent to it.

The bloodvessels are of two kinds: the pulmonary,[5, 15] and bronchial. The former is for the aëration of the blood, and the other for the nourishment of the lungs.

The nerves come from the par vagum and sympathetic.

What composes the *Root* of the lungs? The root of each lung

is formed by the pulmonary artery, and two veins, the nerves, bronchiæ, lymphatic vessels, and glands, covered by the pleura, where it extends from the lungs to the pericardium.

Pleura.

What is the *arrangement* of the pleuræ? They are two in number, afford a perfect covering for each lung, and are reflected over the adjacent sides of the pericardium, and the interior periphery of the thorax.

That portion of the pleura which covers the lung is called *pleura pulmonalis*, and that which lines the thorax is the *pleura costalis;* the two sides being alike. They receive blood from the bronchial and intercostal arteries, and nerves from the intercostals.

The pleuræ divide the thorax vertically into two parts; this septum is called *Mediastinum*, and contains the heart with its coverings and great vessels. The mediastinum is divided into three portions. The *anterior* passes from the front of the pericardium to the posterior face of the middle line of the sternum. The *posterior* passes from the posterior face of the pericardium to the dorsal vertebræ. The *superior* is within the circuit of the first ribs and sternum.

What are contained in the posterior mediastinum? The *thoracic aorta*, the *œsophagus*, the *vena azygos*, the *thoracic duct*, and the *par vagum nerve* of both sides.

What are contained in the superior mediastinum? A part of the remains of the *thymus gland*, *descending vena cava*,[7] *transverse vein*, or *vena innominata*, the *top of the arch of the aorta*,[6] *arteria innominata*,[8] *left carotid*,[9] *left subclavian*,[10] *trachea*,[11] *œsophagus*, *phrenic nerve*, and *par vagum*.

CIRCULATORY SYSTEM.

What is the *apparatus* by which the circulation is effected? The *heart*, which in man consists of four cavities; the *arteries*, *veins*, and *capillaries*.

What are the course and description of the circulation? The blood, after getting to the right auricle, is emptied by its contraction into the right ventricle, from which it is forced through the branches of the pulmonary artery into the lungs. It is returned

through the four pulmonary veins to the left auricle of the heart, which contracts and throws the blood into the left ventricle, from which it is propelled, by its contraction, into the aorta; it is then distributed to the whole body by its small branches, from which it is collected by corresponding veins, into the ascending and descending cava, that empty into the right auricle. It will, therefore, be seen that there are two circulations—the greater or systemic, the arteries of which contain red blood, and the veins dark or venous blood; and the lesser or pulmonic, the arteries of which contain dark blood, and the veins red or vivified blood.

What is meant by the *capillaries?* They are the extreme vascular ramifications which form the connection between the arteries and veins.

Of how many *coats* are the arteries composed? Three: an *external*, a *middle*, and *internal* coat.

The *external* or *cellular* coat is condensed cellular substance, formed into a cylinder, the fibres of which run in every direction.

The *middle* coat, called also *muscular*, *proper*, or *tendinous*, is of a light yellow tinge, the fibres of which are circular, and possess elasticity.

The *internal* coat is sometimes called nervous and arachnoid; it is a thin serous membrane.

Cellular substance, vessels, and nerves also enter into the structure of arteries. The bloodvessels which nourish the arteries are called *vasa arteriarum.*

Of how many coats are the veins composed? Three: an external, a middle, and an internal coat, analogous to the corresponding coats of the arteries, but more delicate in their texture.

Heart.

Where is the heart *situated?* In the thorax between the sternum and spine, having the lungs on either side, and the tendinous centre of the diaphragm below.

It is surrounded by its proper membrane, the pericardium; its weight is about six ounces, greatest length about five and a half inches, and its base about three and a half inches in diameter. It is divided into four cavities; two of which are called *auricles*, and two *ventricles*. The auricles form the base of the heart, and the

ventricles its body. The right auricle and ventricle form the right side of the heart, and the left auricle and ventricle form the left side.

What are the *characteristics* of the *right auricle?*[2] It is an oblong cuboidal cavity, joined at its posterior superior angle by the descending vena cava, and at its posterior inferior angle by the ascending cava. In front it is dilated into a pouch called *sinus*, the upper extremity of which is elongated into a process with indented edges, called *auricle*, or *auricular portion*. On the septum between the auricles is the *fossa ovalis*, which is surrounded by its *annulus*, or the *isthmus* of *Vieussens;* below the *fossa ovalis* is the *Eustachian valve*. At the orifice of the large coronary vein is the *valvula Thebesii*. The opening into the right ventricle is the *ostium venosum*. In this auricle are fasciculi of muscular fibres called *musculi pectinati*.

What are the *characteristics* of the *right ventricle?*[4] It is of the form of a triangular pyramid, forms the greater part of the anterior surface of the heart, and is about three lines in thickness. Its internal surface is covered by muscular fasciculi called *columnæ carneæ;* from some of these, small tendinous cords are sent to the valves, called *chordæ tendineæ*. The valves, three in number, between this ventricle and auricle are called *tricuspid*. The opening for the pulmonary artery is above, and furnished with three valves called *semilunar*, or *sigmoid*, which have in the centre of their edges a small cartilaginous body called *corpusculum aurantii*. Between the outer face of each valve and the artery is a pouch called the *sinus* of *Valsalva*.

What are the *characteristics* of the *left auricle?* Its figure is more regularly quadrangular than the right. Its tip or ear-like portion is situated at the left of the pulmonary artery, and it is longer, narrower, more crooked, and more notched than the right. The opening between the left auricle and ventricle is also called *ostium venosum*.

What are the *characteristics* of the *left ventricle?*[3] The shape of its cavity resembles a long ovoidal or conical body, with its parietes about eight lines in thickness. Its internal surface has the same arrangement as the right ventricle, in having the fleshy columns called *columnæ carneæ*. The *ostium venosum* on this side is furnished by valves called the *mitral*, two in number, the margins of

which are also furnished with *chordæ tendineæ.* The orifice of the aorta is furnished with three *semilunar valves,* corresponding exactly with those at the origin of the pulmonary artery, except that they are thicker and stronger.

The *sinuses* of *Valsalva* also exist in the same manner.

What are the *bloodvessels* of the heart? They are the right and left coronary arteries, and great and lesser coronary veins.

Where are the *nerves* of the heart derived from? Principally from the cervical ganglions of the sympathetic; they follow the coronary arteries in their distribution.

What is understood by the *Pericardium*? It is a membranous sac enveloping the heart. It consists of two layers, an external fibrous and an internal serous. The serous layer lines the fibrous and is then reflected over the heart and roots of the vessels. The internal cavity of the heart is lined by a serous membrane called *endocardium,* duplicatures of which with fibrous tissue form the valves.

ARTERIES.

What is the great trunk of the arterial system called? *Aorta.*

What are the *branches* of the aorta? The *right* and *left coronary arteries,*[3,4] which go to the substance of the heart.

Fig. 43.

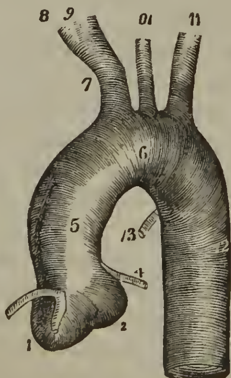
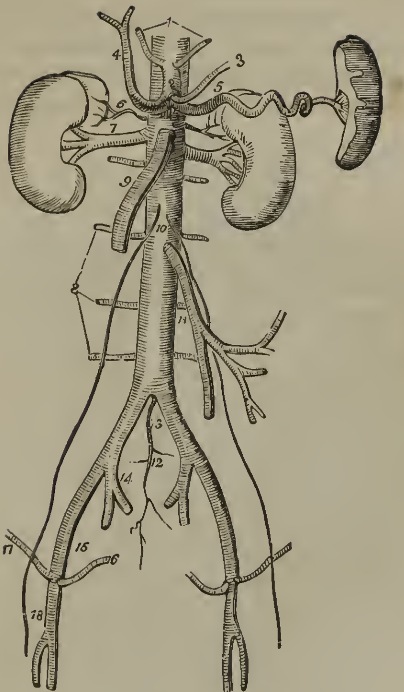


Fig. 44.



From the *arch;* the *arteria innominata,*[7] the *left primitive carotid,*[10] and the *left subclavian arteries.*[11]

From the *thoracic portion;* the *bronchial,* one for each lung, and sometimes two or more, the *œsophageal,* which are five or six small twigs, the *posterior arteries* of the *mediastinum,* and the *inferior intercostals* on each side, which supply the ten lower intercostal spaces.

From the *abdominal portion;* the *phrenics,*[1] two in number, the *cœliac,*[2] the *superior mesenteric,*[9] the *capsular,*[6] one or more on each side, the *emulgents*[17] and *spermatics,*[10] one on each side, the *inferior mesenteric,*[11] the *lumbar,*[8] five on each side, and the *middle sacral*[12] arteries. It then terminates in the *primitive iliacs.*

How is the *Arteria Innominata* divided? Into right subclavian and right primitive carotid.

How are the *Carotids* on each side divided? Into *internal*[3] and *external carotids*,[2] opposites to the os hyoides.

What are the arteries given off by the *Internal Carotid?*[3] The *tympanic*, the *anterior meningeal*, the *opthalmic*, the *communicating artery of Willis*, the *choroid*, the *anterior* and the *middle cerebral.*

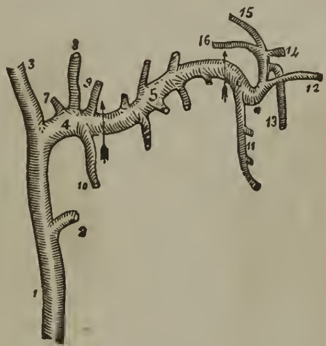
Fig. 45.

What are the branches given off by the *External Carotid Artery?*[2] The *superior thyroid*,[4] the *lingual*,[5] the *facial*[6] (which gives off the *submental*,[7] the *inferior labial*, the *inferior coronary*,[8] and the *superior coronary*[9]), the *mastoid*, the *parotidean*, the *inferior pharyngeal*,[11] the *occipital*,[10, 12, 12] and the *posterior auricular*,[14] when it divides into two large trunks, the *internal maxillary*,[5] and the temporal.[15] The occipital,[10, 12, 12] gives off the cervical.[13]

The *temporal* gives off the *transverse fascial*,[15] the *middle temporal*,[17] and the *anterior*[18] and *posterior temporal*.[16]

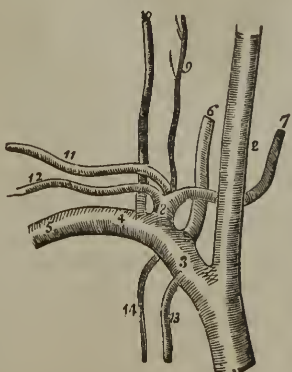
The *internal maxillary*[4] (Fig. 46) sends off the following branches: the *arteria tympanica*,[7] the *arteria meningea parva*,[9] the *meningea magna*[8] or *media*, the *maxillaris* or *inferior*

Fig. 46.



dental,[10] the *temporalis profunda*, two in number, *pterygoideæ*, *buccalis*, *maxillaris superior*,[11] *infra-orbitalis*,[12] *palatina superior*,[13] *pharyngea superior*,[15] and the *spheno-palatina*,[14] which is the terminating trunk.

Fig. 47.



What are the branches given off by the *Subclavian arteries*[3] (Fig. 47) on each side? The *vertebral*,[6] the *inferior thyroid*,[7]

which gives off the *ascending* or *superficial cervical*,[9] *superior intercostal*,[11] *internal mammary*,[13] *profunda cervicis*,[10] and *posterior cervical*;[11] after passing the subclavian muscle, it is called *axillary artery*[5] to the lower margin of the arm-pit; and from this place to the elbow-joint, it is called *brachial*[10] (Fig. 48).

What are the branches of the *Axillary Artery*[9] (Fig. 48)? The

Fig. 48.

Fig. 49.

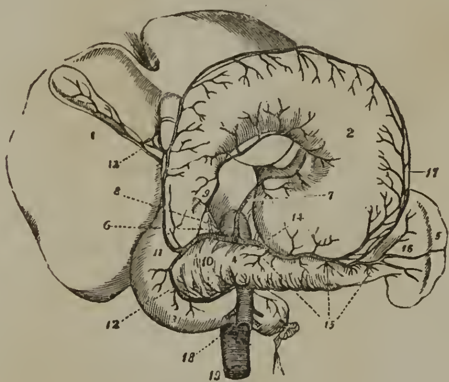
superior scapular, four *external mammary*,[11, 12] *inferior scapular*,[14] and the *anterior* and *posterior circumflex*.

What are the branches of the *Brachial Artery*?[10] The *profound*,[10, 15] the *small profound*,[16] *nutritious*, and *anastomotic*;[17] it then bifurcates into the *radial*[12] (Fig. 49), and *ulnar*[15] in front of the brachialis internus muscle.

What are the branches of the *Radial Artery?* The *recurrens radialis,*[13] *superficialis volæ, dorsalis carpi, magna pollicis, radialis indicis,*[47] and the *palmaris profunda,* which forms the *arcus profundus.*

What are the branches of the *Ulnar*[15] *Artery?* The *recurrens ulnaris,*[18] the *interossea anterior* and *posterior,* and *dorsalis manus.* It then forms the *arcus sublimis*[16] (from which branches are sent that supply the fingers, called *digital*), and terminates by a branch which joins the arteria magna pollicis.

Fig. 50.



What are the branches of the *Cœliac Artery?*[6] It divides into three trunks: the *gastric,*[7] *hepatic,*[8] and *splenic.*[14] This division is sometimes called *tripus Halleri.*

The *gastric artery*[7] passes along the lesser curvature of the stomach.

The *hepatic artery*[8] gives off the *pyloric,*[9] *right gastric* or *gastro-epiploic,*[11] which is distributed to the right half of the great curvature of the stomach; the main branch goes to the transverse fissure of the liver, and divides into the *right* and *left* branches. The *cystic*[13] is given off from the right.

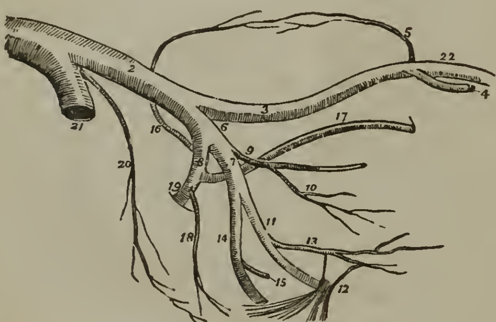
The *splenic*[14] artery gives off the *pancreatic,*[15] the *left gastric,*[17] which is distributed to the left half of the great curvature of the stomach, and the *vasa brevia,*[16] which are given off just before

this artery enters the spleen; they are five or six in number, and distributed upon the great extremity of the stomach, between the cardia and left gastric artery

What are the branches of the *Superior Mesenteric Artery?*[18] There are *three colic arteries*, called *ileo-colica, colica-dextra*, and *colica-media*, besides the principal distribution to the small intestines.

What are the branches of the *Inferior Mesenteric Artery?* The *superior, middle*, and the *inferior colic* arteries; and the *superior hæmorrhoidal.*

Fig. 51.



How are the *Primitive Iliacs*[2] (Fig. 51) divided? Into two trunks, called *internal*[6] and *external.*[3]

What are the branches of the *Internal Iliac Artery?* The *ilio-lumbar,*[16] *lateral sacral,*[18] *obturator,*[17] *middle hæmorrhoidal,*[13] *vesical,*[10] *uterine, gluteal,*[19] and the *ischiatic.*[7] The ischiatic gives off the *internal pudic,*[11] which again gives off the *lower hæmorrhoidal,*[10] *perineal,*[11, 12] *urethro-bulbar,*[13] *ramus superficialis, dorsi penis,* and the *cavernous artery* of the penis.

What are the branches of the *External Iliac?* The *epigastric,*[4] and *circumflex* of the *ilium.*

What is the extent of the *Femoral Artery*, and what are its branches? It extends from the crural arch to its perforation of the *adductor* magnus; and gives off the *superficial* artery of the abdomen, *external pudics, profunda femoris* (which divides into

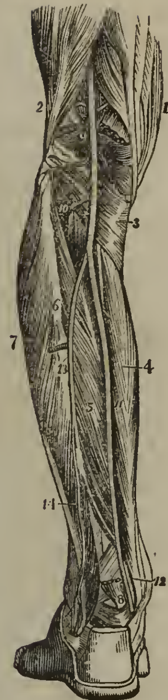
external and internal circumflex); the first, second, third, and fourth *perforating*, and the *anastomosing* arteries.

What is the extent of the *Popliteal Artery* and its branches? It is a continuation of the femoral after its passage through the tendinous insertion of the adductor magnus; extends to the opening in the interosseous ligament, and gives off the *superior internal*,[9] *superior external*,[9] *middle*, *inferior internal* and *inferior external articular* arteries, and the *gastrocnemial;* it then divides into the *anterior* and *posterior tibial*, [11, 12] arteries.

What are the branches of the *Anterior Tibial Artery?* The *recurrent tibial*, *internal* and *external malleolar*, *tarsal*, *metatarsal*, *dorsal* artery of the great toe, and joins with the *external plantar* in the sole of the foot.

What are the branches of the *Posterior Tibial?*[11, 12] The *peroneal*,[13, 14] the *internal* and *external plantar;* this last unites with the anterior tibial artery, and forms the *arcus plantaris*, which gives off the *digital* and the *perforating* arteries.

Fig. 52.



Venous System.

What is the *office* of the veins? To collect the blood from the arteries in all parts of the body, and return it to the heart.

What is their *general arrangement?* There are two accompanying each artery wherever the part is intended for locomotion; besides which there is an abundant class of superficial, or subcutaneous veins, which form a vascular net-work over the whole body. Those accompanying the arteries are termed *venæ comites*, and take the names of the arteries which they accompany. In some other cases, two arteries empty into one vein.

What is their *structure?* Their coats are much thinner than the arteries, but similar to them in structure. The internal coat is

thrown into duplicatures or valves, which are more abundant in the superficial than in the deep-seated veins.

What are the great trunks of the venous system called? *Vena cava ascendens*,[3] and *descendens*[1] (Fig. 53).

Fig. 53.

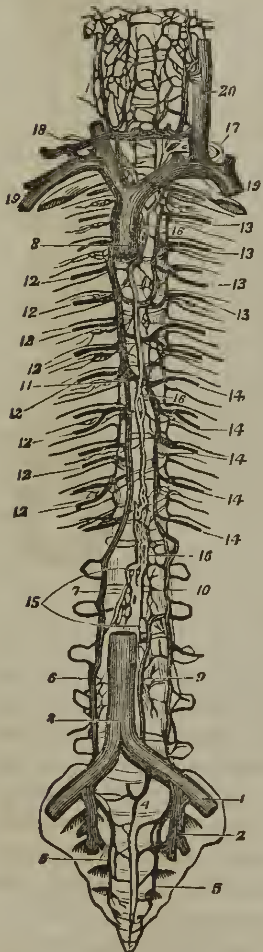
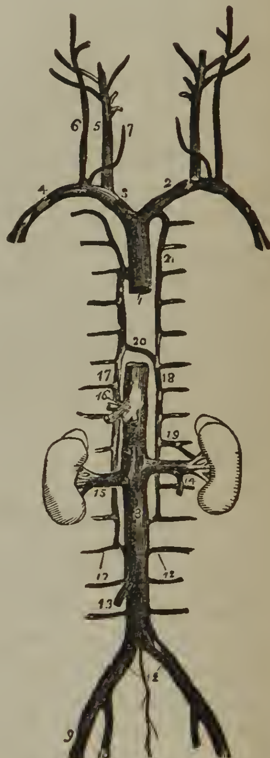


Fig. 54.



What veins form the *Vena Cava Descendens?* The two *venæ innominatæ.*[2,3]

What forms the *Vena Innominata?* It is formed on either side by the junction of the *subclavian*[4] with the *internal jugular.*[5]

What venous trunks discharge into the vena innominata, or descending cava? *Inferior thyroidal, vertebral, superior intercostal, internal mammary, vena azygos,* and some others of smaller size.

What veins form the *Vena Azygos?*[17] The ten inferior intercostals of the right side, and four or six of the left; it anastomoses inferiorly with some of the veins of the abdomen. Those on the left form the *Hemi-Azygos,*[18] and empty into the other by a branch.[20]

What parts are represented by Fig. 54? The *external*[1] and *internal*[2] *iliac veins, vena cava ascendens*[3] and *descendens* with the termination of the vena azygos into it;[8] *middle*[4] and *lateral sacral*[5,5] veins; origin[6] and trunk[7] of the *greater azygos vein* from the lumbar veins; also that of the *lesser*[0] or *hemiazygos,* from the lumbar veins[9] of the left side, and its termination[11] into the greater. The termination of the superior[13 13,13] and right or nine inferior intercostals[12,12,12] in the greater azygos; the five inferior intercostal[14,14,14] veins opening into the lesser; the *receptaculum chyli,*[15] *thoracic duct,*[16,16,16] with its termination[17] in the angle formed between the left subclavian[19] and internal jugular;[20] *right thoracic duct.*[18]

What forms the *Internal Jugular Vein*[5] (Fig. 53)? It extends from the base of the cranium, where it communicates with the lateral sinus on each side, to the internal margin of the first rib. Its commencement is enlarged into what is called its *gulf,* or *sinus.*

What forms the *External Jugular*[6] (Fig. 53), and where does it terminate? It is a continuation of the *temporal,* receives the *facial,* and *lingual,* and sometimes superior *thyroid* and *occipital* veins. It usually terminates in the subclavian.

Where is the *Subclavian* (Fig. 53[4] and Fig. 54[19]) situated? It extends from the axillary to the vena innominata, and goes under the subclavian muscle, in front of the subclavian artery; and where it passes over the first rib, the scalenus anticus muscle is between them, the vein being in front of it.

What forms the *Axillary Vein,* and where is it situated? The

union of the *basilic* with the *brachial* vein. It is in front of the axillary artery, included in the same sheath, and involved with the axillary plexus of nerves. At the under surface of the clavicle it takes the name of subclavian.

How are the veins of the superior extremities arranged? Into *deep seated* and *superficial.* The former take the names of the arteries which they accompany, and are two to each artery. The latter are divided into two principal trunks: the *cephalic* and *basilic.*

What is the situation of the *Cephalic Vein?* It is the trunk coming from the thumb and forefinger, receives several small branches on its course, and terminates in the axillary vein.

What is the situation of the *Basilic Vein?* It begins by the trunk from the ulnar side of the hand, receives branches in its course, and, by its union with the brachial, forms the *axillary* vein

What is the situation of the *Median Vein?* It is in the middle and front of the forearm; its trunk ascends, and below the bend of the arm divides into two; one branch going to the cephalic vein, and called *median cephalic*, and the other going to the basilic vein, and called *median basilic.*

Where is the *Vena Cava Ascendens*[8] (Fig. 53) situated, and what branches does it receive? In front of the spinal column to its right, and extends from the junction of the primitive iliac veins (which unite to form it opposite the fourth lumbar vertebra) to the right auricle of the heart, where it empties. It receives the *middle sacral,*[1] *lumbar,*[12, 12] *right spermatic,*[13, 14] *emulgent,*[15] *capsular, hepatic,*[16] and *phrenic* veins. The left spermatic opens into the left emulgent.

What forms the *Primitive Iliac Vein* on each side? The junction of the external and internal iliacs opposite the sacro-iliac symphysis.

What forms the *Internal Iliac*[10] or *Hypogastric Vein?* It arises by venous branches corresponding with the distribution of the hypogastric artery, some of which are termed plexuses; and are the *hæmorrhoidal*, *vesical*, *sacral*, *pudendal*, *uterine*, and *vaginal plexuses;* and the *gluteal*, *obturator*, and *ileo-lumbar veins.*

What forms the *External Iliac*[9] *Vein?* It is a continuation of the femoral, and receives the epigastric and circumflex iliac veins, which correspond with the arteries of the same name.

What is the arrangement of the veins of the inferior extremities? Into deep seated and superficial. The former follow the course of the arteries, take the same name, and are two for every artery as far up as the ham, and also for the muscular arteries of the thigh.

What are the *superficial* veins? The *saphena minor* and *major*.

What is the situation of the *Saphena Minor*? It commences near the external side of the top of the foot and external ankle; the trunk ascends along the back of the leg superficially, and terminates in the *popliteal* vein.

What is the situation of the *Saphena Major*? It commences at the internal part of the foot; its trunk passes upwards in front of the internal ankle, internal face of the leg on a line with the posterior margin of the tibia, and is continued on a line with the posterior margin of the sartorius muscle; it then terminates in the femoral vein, about twelve or eighteen lines below Poupart's ligament.

From whence is the *Vena Portarum* derived? The viscera of the abdomen, and corresponds with the superior and inferior mesenteric arteries, and the cœliac, with the exception of the hepatic branch.

What is meant by the *Sinus Portarum*? The vena portarum, when it reaches the transverse fissure of the liver, divides into a right and left branch, at right angles with the main trunk, but in a line with one another; these constitute the *sinus portarum*.

Where do the terminating branches empty? Into the *venæ hepaticæ*.

Absorbent or Lymphatic System.

What are the *absorbents*? They are small, pellucid, transparent, cylindrical tubes, whose office is for instertitial absorption, and also to take up the nutritious part of our food.

How are the absorbent vessels divided? Into *lacteals* and *lymphatics*. The former are those which absorb the chyle, and the latter are found in other parts of the system; their structure is similar, and they differ only in the fluid with which they are occupied. They are also divided into *superficial* and *deep seated*.

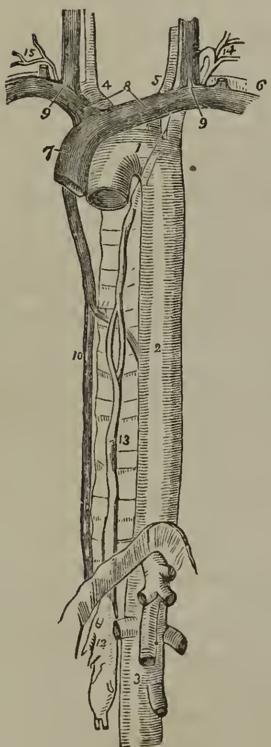
What are lymphatic *glands*? They are flattened, ovoidal bodies, of a reddish-ash color, indurated, and of a variable volume, through

which the lymphatic vessels have to pass on their way to the thoracic duct. The vessels that enter them are called *vasa inferentia*, and those that depart *vasa efferentia.*

Where are they found? In clusters, below the occiput, under the ears and jaw, along the side of the neck, in the axilla, root of the lungs, mesentery, loins, pelvis, &c.

What are the main trunks called? *Thoracic Ducts.*[13,14] What are the course and arrangement of the thoracic ducts? The *left thoracic duct*[13] is the main trunk of the absorbent system. It begins about the second or third lumbar vertebra. Shortly after its commencement it is dilated, and this dilatation is called the *reservoir of Pecquet*, or *receptaculum chyli*[12] The thoracic duct enters the thorax between the crura of the diaphragm, ascends to the fourth dorsal vertebra, when it inclines to the left side, ascends into the neck near the head of the first rib; it then turns downwards[14] and forwards, over the left subclavian artery, and discharges into the point of junction of the left subclavian, and internal jugular veins. It is commonly about the size of a crow-quill.

Fig. 55.



The *right thoracic duct*,[15] or, as it is sometimes called, the *right brachio-cephalic*, is about one inch long, and descends to empty itself into the junction of the right internal jugular with the right subclavian veins. It is formed by the lymphatic trunks of the right side of the head and neck, from the right upper extremity, and the superficial lymphatics of the right side of the thorax, and parts adjacent to it.

What else is represented by Fig. 55? The *aorta*,[1,2,3] *arteria innominata*,[4] *left carotid*,[5] *left subclavian*,[6] *superior cava;*[7] the two *venæ innominata*,[8] *internal jugular*,[9,9] *vena azygos.*[10]

NERVOUS SYSTEM.

What is the essential ingredient of this system? A peculiar animal matter called *neurine*.

How is the nervous system divided? Into the *central* or *internal* part, composed of the *brain* and *spinal marrow;* and the *external*, or *peripheral* portion, which consists in the nerves of the *brain* and *spinal marrow;* and into the *sympathetic system of nerves.*

The central portion is composed of two kinds of substance; one called *medullary*, and the other *cineritious.*

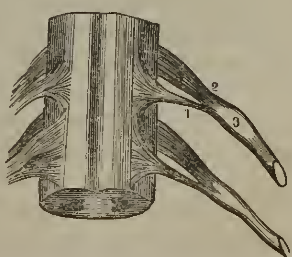
The peripheral portion, or the nerves, are formed by parallel fasciculi, the finest filaments of which are composed of a tube filled with nervous matter. The sheath of the nerves is called *neurilemma;* it envelopes the nerves, and also forms an envelope for each particular fibre and fasciculus, and is an extension of the pia mater and dura mater along the nerves.

There are three modes by which these fasciculi unite with each other: by *anastomosis*, *plexus*, and *ganglion.*

Spinal Marrow.

What are the *characteristics* of the spinal marrow[3] (Fig. 60 and Fig. 56)? It is within the vertebral cavity, and extends from the first vertebra of the neck to the first or second of the loins, inclusive. It has four membranes—*dura mater*, *pia mater*, *membrana dentata*, and *tunica arachnoidea:* its general form is cylindrical, flattened slightly before and behind; its substance is of two kinds—cineritious and medullary. It is divided by sulci into four fasciculi or cords on each side, viz: *Anterior* or *motor* columns, which give origin to the motor roots of the spinal nerves. *Lateral* columns, which are divided in function between motion and sensation, and have been described by Sir Charles Bell as the *respiratory tract.* *Posterior*, or columns of *sensation*, which give origin to the sensitive

Fig. 56.



roots of the spinal nerves. *Median posterior* columns, which have no separate function assigned to them at present.

The spinal marrow gives off from its sides thirty pairs of nerves; eight of them are called *cervical*, twelve *dorsal*, five *lumbar*, and five *sacral*. The spinal nerves are formed from two roots — an anterior[1] or motor, and a posterior[2] or sensory, which are separated by the *ligamentum denticulatum*. A ganglion is formed on the posterior root, beyond which the two roots unite, and proceed to their proper destination.

The arteries of the spinal marrow are derived from the *vertebrals*, *intercostals*, *lumbar*, and *sacral*.

Brain.

What is understood by the *encephalon* or *brain?* It is that part of the central portion of the nervous system contained within the bones of the cranium; of an oval shape, surrounded by three membranes, the *dura mater*, *tunica arachnoidea*, and *pia mater*. Its substance is divided into *cineritous* and *medullary*.

The brain is divided into *Medulla Oblongata; Protuberantia Annularis*, or *Pons Varolii; Cerebrum;* and *Cerebellum*, each of which are symmetrical, and consist in right and left halves, perfectly alike.

What are the *processes* of the dura mater? *Falx cerebri*, *tentorium cerebelli*, and *falx cerebelli*.

What are the *sinuses* of the *Dura Mater?* *Superior longitudinal*, *lateral* (one on each side), *inferior longitudinal*, *sinus quartus* or *rectus*, *petrous* (two on each side, the *superior* and *inferior*), *cavernous* (one on each side), *circular*, and the *occipital*. The arteries that supply the dura mater are the anterior meningeal, a branch of the internal carotid; the middle meningeal and meningea parva, branches of the internal maxillary; the inferior meningeal, from ascending pharyngeal and occipital arteries; and the posterior meningeal from the vertebral. The nerves are derived from the nervi molles and vertebral plexus of the sympathetic, from the Casserian ganglion, the opthalmic nerve, and sometimes from the fourth.

What is the *Torcular Herophili?* It is the union between the longitudinal, the fourth, and the lateral sinuses.

What are the characteristics of the *Medulla Oblongata*[6] (Fig. 57)? It extends from the superior margin of the first cervical vertebra to the middle of the basilar process of the os occipitis. On its under surface, on each side, is the *Corpus Pyramidale*[1] (Fig. 59.)

The *Eminentia Olivaria* (Fig. 59[3] and Fig. 60[23]) are two bodies, one on either side, at the external margin of the pyramidal bodies, with the *corpus fimbriatum* in the centre, and the *olivary tract*[14] (Fig. 60) which goes to the optic tubercles.

The *Corpora Restiformia* (Fig. 59[4] and Fig. 60[6]), one on either side, are placed at the lateral margins of the medulla oblongata, posterior to the olivaria, and are a continuation of the posterior portion of the medulla spinalis. Between the corpora restiformia, on the superior face of the medulla oblongata, is an excavation, named from its shape *calamus scriptorius*, which forms a part of the floor of the fourth ventricle of the brain.

What are the characteristics of the *Pons Varolii* (Fig. 57,[5] Fig. 59,[2] and Fig. 60[7])? It is a large projecting body, placed at the top of the medulla oblongata upon the junction of the body of the sphenoid bone with the basilar process of the os occipitis, convex, and about one inch in diametr. Four crura proceed from it.

What are the characteristics of the *Cerebellum*,[2,2] (Fig. 60)? It is in the posterior fossa of the cranium, separated from the posterior lobes of the cerebrum by the tentorium, and connected with the pons Varolii by the crura of the cerebellum. It measures four and a half inches in the transverse diameter, two and a half in thickness, and about the same from before backwards. It has on its superior face the *sulcus superior cerebelli;* another on the inferior surface, called the *sulcus inferior cerebelli.*

The superior middle ridge is called *vermis superior*, the anterior extremity of which is from its elevation called *monticulus cerebelli.* The *vermis inferior* is a ridge occupying the deep sulcus which divides the cerebellum on its inferior surface into hemispheres. The central part of the cerebellum is formed by the vermis superior and inferior, and is the fundamental portion.

The *valve* of *Vieussens* arises from the cerebellum under the anterior part of the base of the monticulus.

The *corpus rhomboideum*, or *dentatum*, is in the middle of the trunk of the *arbor vitæ.* The cerebellum is associated with the

spinal cord and cerebrum by three pairs of pedicles, viz: *corpora restiformia; processus cerebello ad testes;* and *crura cerebelli.*

What are characteristics of the *Cerebrum?* It weighs about three pounds; it is ovoidal, measures about six inches in its antero-posterior diameter, five inches in breadth, and four or five deep. It is separated by the longitudinal fissure into *hemispheres*, the right and left. At the bottom of this fissure is the *corpus callosum*, which connects the two hemispheres together. The hemispheres are each divided on their under surface into three lobes, *anterior, middle,* and *posterior.* The anterior is anterior to the *fissure of Sylvius;* the posterior rests on the tentorium, and the middle is between these two.

The periphery is formed into convolutions, called *gyri*, and these are separated by fissures called *sulci.*

The *Crura Cerebri*[11] (Fig. 60) are two thick white cords which issue from the pons Varolii, are about eight lines long, mutually diverge to each side to enter the *thalami optici*, and are separated by a fissure, which is the *third ventricle* of the brain.

The *Eminentia Mammillaria*, or *Corpora Albicantia*[3] (Fig. 57), are two small bodies, one on each side, situated near the anterior extremities of the crura cerebri, and are connected with the thalami optici by two white cords; they are the anterior extremity of the crura of the fornix.

The *Infundibulum*[4] (Fig. 57) is placed immediately before the eminentia mammillaris. It is flattened, conoidal, half an inch long, base upward, and its apex going downwards and forwards. Its base is hollow, and opens into the third ventricle, but the point is closed.

The *Pituitary Gland* is situated in the sella turcica.

The *Tuber Cinereum*[4] (Fig. 60), or *Pons Tarini*, is a portion of the under surface of the crura cerebri, and forms part of the floor of the third ventricle.

The *Thalami Optici*[5] (Fig. 60, divided vertically), two in number, called also *Ganglia Postica*, are situated on the superior face of the crus cerebri, about an inch and a half in length, and eight lines broad and deep. The thalami are medullary externally, cortical, and medullary internally, and united to each other by the *commissura mollis.*

The *Corpora Striata*, or *Ganglia Cerebri Antica*, are two

pyriform bodies, situated before the thalami, at the bottom of the lateral ventricles. They are two and a half inches long, convex in their upper surface, eight lines broad at the front, and taper backward to a point. The *Septum Lucidum* is between them in front, but posteriorly they diverge so as to admit the thalami between them. The *Tænia Striata* is placed in the angle formed between the internal margin of the corpus striatum and the external one of the thalamus opticus. It is a small medullary band commencing near the anterior crura of the fornix, and observing the course of the curved fissure in which it is placed; it goes to the posterior end of the corpus striatum.

The *Corpus Callosum* is placed at the bottom of the fissure which separates the two hemispheres, and may be brought into view by slicing them off to a level with it. It is then seen to be a medullary layer uniting the mass of the two hemispheres for two-fifths of the long diameter of the brain, about eight lines in breadth, marked by a middle line called *raphé*, and forms the roof of the lateral ventricles.

The *Fornix* or *Trigone Cerebral* is placed immediately below the corpus callosum. It is triangular, the base of which is behind, and the apex in front, about an inch and a half long in its body, and one inch wide at the base, which is beneath the corpus callosum, continuous with it, and gives the fornix the appearance of being a part of the same structure doubled on itself.

The *Septum Lucidum* is a partition placed vertically in the middle of the brain, and extends from the corpus callosum above, to the fornix below; between its lamina is situated the *fifth ventricle*, or *ventriculus septi*.

The *Pineal Gland* is beneath the posterior margin of the fornix, upon the superior part of the tubercula quadrigemina.

The *Velum Interpositum* is a reflection of pia mater, separating the pineal gland from the fornix, and the fornix from the thalami nervorum opticorum. Its edges contain a plexus of veins called the *plexus choroides*.

The *Tubercula Quadrigemina* are situated on the superior face of the crura cerebri, and just behind the thalami. They consist of four rounded elevations, separated by a crucial furrow. The larger pair is above, and called *nates*, and the other is called testes.[1] Under these is a passage called the aqueduct of Sylvius. Fig. 60.

How many *Ventricles* of the brain are there? Four; *two lateral*, placed one in either hemisphere of the cerebrum, the *third*, *between* the *two thalami*, and the fourth *under* the *cerebellum*.

The *Lateral Ventricles* each consist of a body and three processes, called *cornua*. The cornua are named from their position *anterior*, *posterior*, and *lateral*, or *inferior*.

In the *posterior cornu* are seen the *hippocampus minor*. In the *inferior*, or *lateral cornu*, is found the *cornu ammonis*, or *hippocampus major*, terminated by the *pes hippocampi*.

The *Third Ventricle* is bounded below by the pons tarini, crura cerebri, and the eminentiæ mamillares; and above by the velum interpositum and fornix.

The *Fourth Ventricle* is bounded in front by the tuber annulare, and medulla oblongata; behind, by the fundamental portion of the cerebellum; above, by the *valve of the brain* and tubercula quadrigemina; laterally, by the medullary prolongations from the cerebellum to the tubercula quadrigemina, and is open below when the pia mater is removed.

Nerves.

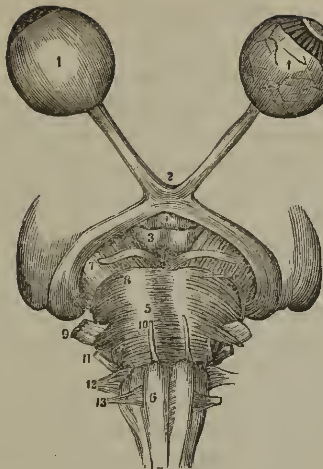
The following nerves are in pairs, and the description of one side applies equally to the other: —

Where does the *Olfactory Nerve* arise from? By three fasciculi or roots from the basis of the brain at the corpus striatum, and coalesce in the fissure of Sylvius. They unite, and at the anterior extremity this nerve is enlarged into what is termed the bulb, which sends from its under surface filaments to the Schneiderian membrane through the cribriform plate of the ethmoid bone.

Where does the *Optic Nerve*,[8, 8, 9] (Fig. 60) arise from? It arises by a broad flattened root, a portion from the thalamus opticus[9] (Fig. 60), and another part from the tubercula quadrigemina; it also adheres to the crus cerebri, and passes under it. The optic nerves of the two sides are fused together, and form what is called their *chiasm*[2] (Fig. 57), or *crossing;* after this they separate, and each one passes through the optic foramen of its respective side.

Where does the *Third Pair*[7, 10] (Figs. 57 and 60) of nerves, or *Motor Oculi*, arise from? From the internal face of the crus cerebri[11] (Fig. 60), two lines in advance of the anterior margin of the tuber annulare[5] (Fig. 57). It penetrates the orbit, through

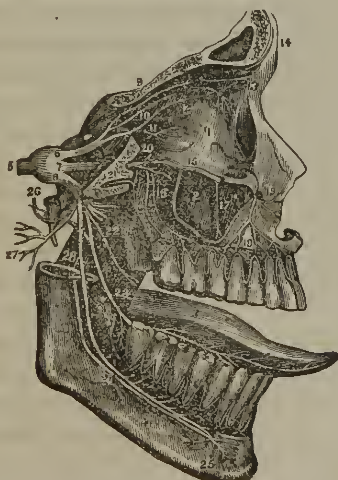
Fig. 57.



the sphenoidal fissure, and it is distributed to most of the muscles of the eyeball.

Where does the *Fourth Pair* [8, 12] (Figs. 57 and 60) of nerves, or *Patheticus* arise from? It arises by two filaments from the upper

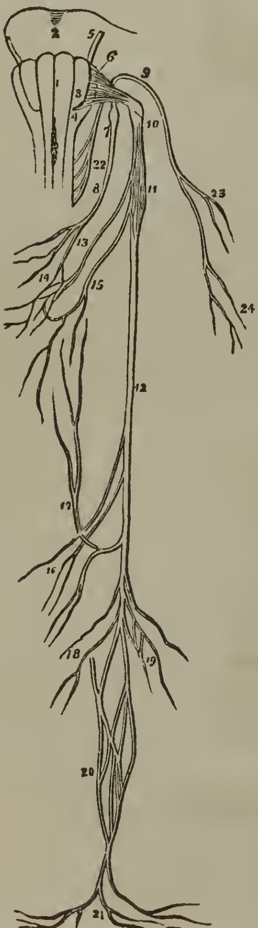
Fig. 58.



anterior face of the valve of the brain. It goes to the orbit through the sphenoidal fissure, and is distributed to the superior oblique muscle.

Where does the *Fifth Pair*[9, 15, 16] (Figs. 57 and 60) of nerves, or *Trifacial*, arise from? By several distinct filaments from the medulla oblongata, but emerges from the pons Varolii[5] (Fig. 57), or tuber annulare. They unite, and form the semilunar ganglion, or *ganglion* of *Casser*[5] (Fig. 58), which sends off three branches, viz: the first, or *opthalmic*,[6] through the sphenoidal fissure; the second, or *superior maxillary*,[7] through the foramen rotundum; and the third, or *inferior maxillary*,[8] through the foramen ovale. Their general distribution is to the orbit, the face, and the tongue.

Fig. 59.



What other parts of the fifth pair and adjacent parts are represented by Fig. 58? The *orbit*,[1] *antrum Highmorianum*,[2] *tongue*, *frontal branch*[9] of the opthalmic nerve dividing into *external* and *internal*, *lachrymal*,[10] *nasal*,[11] *internal nasal*,[12] *external nasal*,[13] *external* and *internal frontal*,[14] *infra-orbitar*,[15] *posterior dental*,[16] *middle dental*,[17] *anterior dental*,[18] *labial* and *palpebral*,[19] *pterygoid*[21] from Meckel's ganglion, *anterior branches*[22] of the third branch, *lingual*,[23] *inferior dental*,[24] its *mental branches*,[25] *auricular branches*,[27] *mylo-hyoid*.[28]

Where does the *Sixth Pair*[10, 17] (Figs. 57 and 60) of nerves, or *Motor Externus*, arise from? From the base or upper extremity of the corpus pyramidale. It passes into the orbit by the sphenoidal fissure, and is distributed upon the abductor oculi muscle.

Where does the *Seventh Pair*[11, 18] (Figs. 57 and 60) of nerves, or *Facial* and *Auditory*, arise from? That portion of the seventh pair, called the facial, or portio dura, arises by two branches from the medulla oblongata. It emerges through the stylo-mastoid foramen, and is distributed to the muscles and skin of the head, having the name of *pes anserinus*.

That portion called the *Auditory*, or *portio mollis*[19] (Fig. 60), arises from the medullary striæ on the surface of the calamus scriptorius, and from the corpus restiforme. It penetrates the meatus auditorius internus, and is distributed to the labyrinth of the ear.

Where does the *Eighth Pair*[12] (Fig. 57), arise from? That portion of the eighth pair called *Glosso-pharyngeal* (Fig. 59,[6, 7, 8] and Fig. 60[20]), arises from the posterior cord[4] of the medulla oblongata. It emerges[8] through the foramen lacerum posterius, and is distributed to the tongue and pharynx.

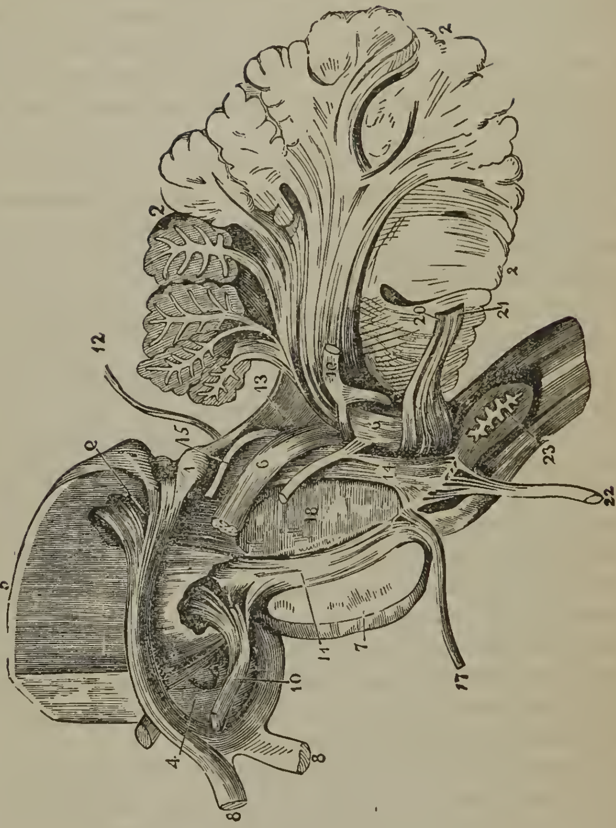
That portion called *Pneumogastric* (Fig. 59,[10, 11, 12] and Fig. 60[21]), arises from the corpus restiforme[4] of the medulla oblongata. It passes out through the foramen lacerum posterius, and is distributed to the organs of respiration, and to the stomach.

That portion called the *Accessory*[9] nerve arises from the posterior fasciculus of the medulla oblongata, and spinal marrow. It is formed by the union of six or seven roots from the spinal marrow, and three or four from the medulla oblongata, and passes into the cavity of the cranium through the foramen magnum, passes out again through the foramen lacerum posterius, and is distributed to the muscles and integuments of the neck.

What other parts are represented in Fig. 59? The *ganglion*[10] of the pneumogastric, its *plexiform ganglion*[11] lower down, and its *trunk;*[12] its *pharyngeal* branch, which, along with a branch from the *glosso pharyngeal*[8] and *superior laryngeal*,[15] forms the *pharyngeal plexus*.[14] We then have the *cardiac*[16] branches given off; also the *recurrent laryngeal*,[17] *anterior*,[18] and *posterior pulmonary*.[19] It then forms the *œsophageal plexus*,[20] and terminates in the *gastric branches*.[21]

Where does the *Ninth Pair*[13, 22] (Figs. 57 and 60) of nerves arise from? By several fasciculi, from the fissure which separates the corpus pyramidale[1] (Fig. 59) from the corpus olivare,[3] on the medulla oblongata. It gets out of the cranium through the ante-

Fig. 60.

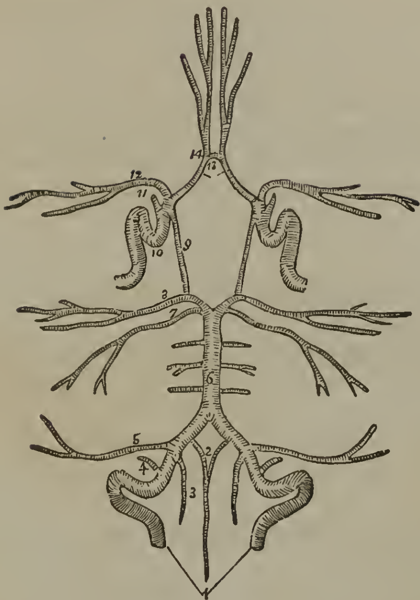


rior condyloid foramen, and is distributed to the mascles of the tongue.

From whence are the arteries of the brain derived? From the internal carotids and vertebrals.

The internal carotid passes into the cranium through the carotid canal; when it reaches the anterior clinoid process, it sends off the ophthalmic artery to the orbit. It is then distribnted to the brain by the arteria choroidea, arteria callosa, or anterior cerebri, arteria communicans anterior, and the arteria cerebri media.

Fig. 61.



The vertebral arteries[1] (Fig. 61) are branches of the subclavian, and pass through the transverse processes of the six superior vertebræ of the neck, enter the cranium through the occipital foramen, and continue till they reach the posterior margin of the tuber annulare, when the two coalesce, and form a single trunk called the basilar.[6] Before this union, it sends off the spinalis posterior[3] and anterior,[2] and the inferior cerebelli.[5] The basilar gives off the arteria superior cerebelli;[7] it then divides into the posterior artery of the cerebrum,[8] one on each side. These last arteries are joined by the arteria communicans posterior,[9] which completes the circle of Willis.

How is the *Circle of Willis* formed? Anteriorly and laterally by the internal carotids[10, 10] and their branches; the posterior part by the basilar,[6] and its bifurcation, and forms a free communication between the vessels of the two sides of the brain.

What other branches are represented by Fig. 61? The *ante-*

rior cerebri,[13] *middle cerebral,*[12] *anterior communicans,*[14] and the *ophthalmic.*[11]

Senses.

From what source is the *pituitary membrane* supplied with nerves? From the olfactory, or first pair, and from the fifth pair.

From what source are the *bloodvessels* of the nose derived? From the internal maxillary, and the ophthalmic arteries.

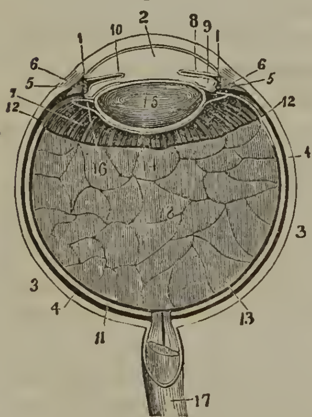
Eye.

What constitutes the organ of vision? The *ball* of *the eye*, and its *auxiliary parts.*

What are the *auxiliary parts* of the eye? The *eyelids*, or *palpebræ supercilia, ligamentum palpebrale externum, conjunctiva, glands of Meibomius, cilia, muscles, lachrymal apparatus*, consisting of the lachrymal glands, *lachrymal duct, lachrymal sac, lachrymal caruncle, semilunar valve* or *fold,* and *puncta lachrymalia.*

The muscles are the levator palpebræ superioris, the *four recti,* and *two oblique.*

Fig. 62.



What *nerves* supply the orbit of the eye? They are derived from the motor oculi, or third pair, the trochlearis, or fourth pair, the first branch of the trigeminus, or fifth pair, and the motor oculi externus, or sixth pair.

What *arteries* supply the orbit of the eye? The ophthalmic, which has numerous branches.

What forms the ball of the eye? It is formed by concentric *tunics*, and *humors* contained in them. The tunics are the *sclerotica*[3,3] and *cornea*[1,1] (Fig. 62) externally; the *choroidea*[4,4] and the *iris*[8] next in order; and the *retina*[11] internally.

The *humors* are the *vitreous,*[12] which constitutes the principal part of the eyeball; the *crystalline,*[15] which is in front of the *vitreous;*[18, 18] and the *aqueous*, between the crystalline and the cornea.

The *choroid coat,*[4, 4] is united at its anterior margin to the sclerotica by the ciliary ligament.

The *pigmentum nigrum* is spread over the whole internal surface of the choroid, between it and the retina.

The *vitreous humor*[13] is composed of the *tunica hyaloidea*[13] and a *thin fluid.*

What other parts are represented in Fig. 62? The *ciliary ring* or *ligament*[5, 5] with its internal surface,[6] *ciliary body,*[8] *posterior* or *chamber*[9] of the aqueous humor, *termination* of the retina,[12, 12] *canal of Petit,*[16] and *optic nerve*[17] with its investment.

Ear.

How is the ear divided? Into the *external ear*, the *tympanum*, and the *labyrinth.*

Of what is the *external ear* composed? It is formed of the exterior portion commonly called the ear, and by a canal which leads internally to the tympanum. The outer portion is divided into *pinna* and *lobus;* the former is the cartilaginous portion, and the latter is soft and *pendulous*, attached to its inferior portion.

The different parts of the external ear are, the *concha, meatus auditorius externus*, the *helix, antihelix, fossa innominata, tragus*, and *antitragus.*

The *muscles* of the external ear are very feebly developed, and are *helicis major* and *minor, tragicus, antitragicus, transversus auriculæ, attolens auriculæ, retrahens auriculæ*, and the *anterior auriculæ.*

What is the situation of the *Tympanum?* It is interposed between the meatus auditorius and the labyrinth. It is three lines in depth, six in the antero-posterior diameter, and the vertical measurement about the same.

The *membrana tympani* is situated between the meatus externus and tympanum, and is composed of four lamina.

The floor of the tympanum is marked by a rising called the *promontory*, and openings called the *foramen ovale* and *foramen*

rotundum; the latter in the dried bone is the opening to the cochlea.

The *eminentia pyramidalis* is a small eminence, projecting from the posterior part of the tympanum; it is hollow, and communicates at the other end with the canal of *Fallopius.*

The *Eustachian* tube is at the fore part of the tympanum, and communicates at the other extremity with the pharynx.

The bones in the tympanum are the *malleus, incus, orbiculare,* and *stapes,* which are successively articulated, so as to form a chain. The muscles which move these bones are the *laxator tympani, tensor tympani, stapedius,* and the *laxator tympani minor.*

What is the situation of the *labyrinth?* It is placed on the inner side of the tympanum, and is divided into three portions, the *vestibulum, semicircular canals,* and the *cochlea.*

The nerves which are spent in part or wholly upon the organ of hearing are the *auditory, portio dura,* and *trigeminus,* or *fifth pair.*

The Great Sympathetic Nerve.

What is meant by the *Sympathetic Nerve?* It consists of two chains of ganglia extending from the base of the cranium to the lower extremity of the sacrum. These ganglions are united together by an intermediate nervous cord, and send off filaments to adjacent organs; there is one of them for each intervertebral space, except those of the neck. The ganglion of Ribes unites the two halves of the sympathetic system superiorly, and has been considered as its origin; inferiorly, they are united by a ganglion on the median line of the coccyx,

It supplies all the internal organs of the body through plexuses, which take the name of the artery which they accompany.

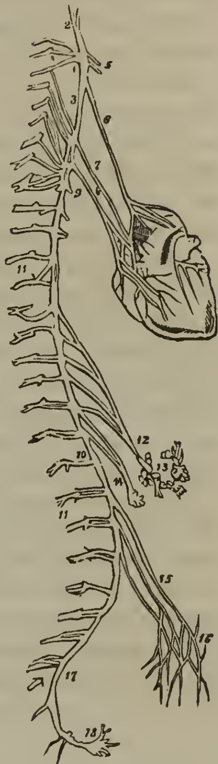
What is the arrangement of the *Sympathetic* at its upper portion? There are six cranial ganglia, the *ganglion* of *Ribes; ganglion* of *Laumonier*, called also *ganglion caroticum*, or *ganglion cavernosum;* the *lenticular* or *ciliary ganglion;* the *spheno-palatine ganglion*, or *ganglion* of *Meckel;* the *otic ganglion*, or *ganglion* of *Arnold;* and the *submaxillary ganglion.*

How many *Cervical Ganglions* are there? Three, a superior, middle, and inferior.

The first is opposite to the transverse process of the second cer-

vical vertebra, and behind the internal carotid artery. It has many branches, some of which communicate with the anterior trunks[4] of the first, second, and third cervical nerves; sends a branch[2] also to the carotid plexus, and one to the second cervical ganglion; it connects[5] also with the facial, eighth, and ninth nerves, and with the pharyngeal plexus. Some branches join to form the superior cardiac nerve,[6] which goes to join the cardiac ganglion. The middle is opposite to the space between the fifth and sixth cervical vertebra. It is small, sometimes wanting, and rests upon the inferior thyroid artery, and is often called thyroid ganglion. It joins the first and third cervical ganglion, and is connected to the anterior trunks of the third, fourth and fifth cervical nerves, and sends the middle cardiac nerve to join the cardiac plexus. The inferior is formed in the interval between the head of the first rib and the transverse process of the last cervical vertebra. It joins the sixth, seventh, and eighth cervical nerves; also the middle cardiac nerve[7] and cardiac plexus, by means of the inferior cardiac nerve.[8]

Fig. 63.



Where is the *Cardiac Plexus* situated? Between the arch of the aorta and the lower part of the trachea and bronchiæ. It is formed principally from the branches sent by the three cervical ganglions of the sympathetic of each side; there are filaments also from the recurrent and the par vagum. This plexus is distinguished by the softness of its texture, and its branches may be divided into *anterior*, *posterior*, and *inferior*.

How many *Thoracic Ganglions* of the sympathetic are there? Twelve; they are placed on or near the heads of the ribs, are connected together by the main cord of the sympathetic, and receive filaments from the dorsal nerves.

What are the *Branches* of the thoracic ganglions? The *great splanchnic nerve*[12] arises by small branches from the sixth, to the ninth or tenth thoracic ganglions, inclusive.

The *small*[14] *splanchnic nerve* is derived from the tenth and eleventh thoracic ganglions.

Where is the *Semilunar Ganglion*[13] situated? On each side of the aorta, and is formed by an assemblage of several smaller ones, which receive their fasciculi from the great splanchnic nerves. These several ganglia are united together, and form the root of the solar plexus, from which proceed branches to the viscera; viz: the cœliac, or stomachic plexus, to the liver, duodenum, and pancreas, the splenic to the spleen, &c., each following the arteries as they proceed to their respective destinations.

How many *Lumbar Ganglions* of the sympathetic are there? Five on either side, placed anteriorly on the side of the bodies of the lumbar vertebræ.

How is the *Hypogastric Plexus*[16] formed? By branches of the lumbar and aortic plexuses, and filaments from the sacral ganglia. All the viscera of the pelvis are supplied from it.

How many are there of the *Sacral Ganglions?*[18] Generally three, sometimes four or five, on the anterior face of the sacrum, near the corresponding foramina for the transmission of the sacral nerves. The last of the sacral ganglions detaches downwards one or more filaments, which anastomose with the corresponding ones of the opposite sides and form a sort of arch, or coccygeal ganglion, which is the termination of the sympathetic nerve.

Spinal Nerves.

How are the nerves of the medulla spinalis arranged? The anterior or motor root unites with the posterior or sensitive, in the intervertebral foramina; then a division takes place into posterior or smaller, which supplies the muscles of the back; and into anterior or larger, which connects with the ganglions of the sympathetic nerve, and also form plexuses which furnish the principal nerves to the muscles of the trunk and extremities.

What is the origin of the *Phrenic Nerve?* It arises from the anterior fasciculus of the second and third cervical, and generally by two or three filaments from the upper part of the brachial plexus.

What nerves contribute to form the *Brachial Plexus?* The anterior branches of the four inferior cervical nerves, and the first dorsal or thoracic. It extends from the scaleni muscles to the axilla on a level with the neck of the os humeri, and surrounds the axillary artery like the braids of a whip cord, from the clavicle to the os humeri, below its head.

What nerves proceed from the axillary or brachial plexus? The *scapular*, *thoracic*, *axillary*, *two cutaneous*, *radial*, *ulnar*, and *median*.

What is the number of *Thoracic* or *Dorsal* spinal nerves? They consist of twelve pairs.

What is the number of the *Abdominal* spinal nerves? There are five lumbar, and five, sometimes six, sacral, on each side.

The anterior fasciculi form a plexus from the upper part of the loins to the lower part of the sacrum, called the *plexus cruralis*, which has been divided by anatomists into *plexus lumbalis*, formed by the four superior lumbar nerves, and the *plexus ischiadicus*, formed by the last lumbar and the sacral.

What are the nerves given off by the *Lumbar Plexus?* The *cruralis anterior*, *nervus obturatorius*, a branch running to join the sciatic plexus, the *abdomino-crural* branches, *spermaticus externus*, *cutaneus externus*, *cutaneus medius*, *cutaneus anterior*, and *cutaneus internus*.

What are the branches which are given off by the *Sciatic Plexus* or *Plexus Ischiadicus?* The *nervi glutei*, *nervus pudendalis longus inferior*, *ramus femoralis*, *cutaneus posterior*, *nervus pudendalis longus superior*, and the *nervus ischiadicus*, or *great sciatic*.

What is the division of the great *Sciatic Nerve?* The *popliteal* or *posterior tibial*, and the *peroneal;* and in its course gives off the *cutaneus internus superior*, the *cutaneus internus inferior*, and a large trunk or three distinct branches, which go to the adductor magnus, semi-membranosus, biceps, and semi-tendinosus.

The *peroneal* nerve divides into two branches, the *peroneus externus*, and the *tibialis anterior*.

The *posterior tibial* or *popliteal* nerve gives off the *external saphenus*, and several small branches to the muscles of the leg, when it divides in the hollow of the os calcis into the *internal* and *external plantar* nerves.

PART II.

PHYSIOLOGY.

PART II.—PHYSIOLOGY.

Natural Bodies.

How are bodies divided? Into *Inorganic* and *Organic.*

What are some of the properties of *Inorganic* bodies? They possess the common properties of matter, and their elements are fixed under ordinary circumstances.

What are the general properties of *Organic* bodies? They have properties in common with the inorganic, but also have others controlling the first in a remarkable manner. Their elements are undergoing constant changes, and the sciences which give us a knowledge of their structure and functions are called *Anatomy* and *Physiology.*

In what respects do they differ? They differ in regard to their *origin, shape, size, chemical character, texture, mode of preservation, termination,* and *motive forces.*

What are the objects of the Science of Physiology? They are to explain the mode in which a living being is *born, nourished, reproduced,* and *dies.*

How are organic bodies divided.? Into *Animals* and *Vegetables.*

In what respects do these differ from each other? In *composition, texture, sensation* and *voluntary motion, nutrition,* and *reproduction.*

The distinctions between them are not so rigidly fixed as between the inorganic and organized.

Both vegetables and animals are endowed with functions termed *vegetative, plastic,* or *organic;* but animals have other functions superadded, viz: *sensation* and *voluntary motion,* which distinguish them, and are termed *animal,* while the functions common to both are termed *organic.*

They differ in composition, which can be easily detected by burning, from the odor given out.

Mulder says that cellulose ($C^{24}H^{21}O^{21}$) forms the principal parts of the cellular mass in plants; and in animals the primary material is gelatine ($C^{13}H^{10}N^{2}O^{5}$).

The texture differs very much: fluids predominate in animals, solids in vegetables. Only one elementary tissue, the *vesicular* or *areolar*, exists in vegetables; while in the animal there are three, the *areolar*, the *muscular*, and the *nervous*.

Nutrition is effected differently in the two classes. In animals, the food has to be changed so as to adapt it for nourishment. This change takes place in an internal organ called the stomach, and the process is termed *digestion;* absorption of the prepared material then takes place from its internal lining, by which a supply of nutriment is furnished. There are important differences also in the steps which precede the reception of food, requiring volition, &c.

In *reproduction*, a close analogy exists, but there are also differences connected with sensibility and voluntary motion, controlling the union of the sexes in animals, while in vegetables there is neither perception nor volition.

What are the two kinds of elements which enter into the composition of the human body? They are the *chemical* or *inorganic*, and the *organic*, which are compounds, and are the product of vital actions.

What are the *chemical* or *inorganic* elements? *Oxygen, hydrogen, carbon, nitrogen, phosphorus, calcium;* and in smaller quantity, *sulphur, iron, manganese, silicium, potassium, aluminum, chlorine, sodium, magnesium,* &c. &c.

What are the principal *ultimate* elements? The animal bodies consist essentially of oxygen, hydrogen, carbon, and azote, as a general rule.

How are the organic elements divided? Into those which contain nitrogen and those that do not.

What are those in which nitrogen is contained? *Protein*, including *albumen, fibrin, caseum* or *casein; globulin; pepsin; gelatin; chondrin; osmazome; mucus; urea; uric* or *lithic acid; red coloring principle* of the *blood* (*hematin* or *hematosin*); *yellow coloring principle* of the *bile.*

What are the characteristics of *Protein?* It is procured by

dissolving albumen, fibrin, or casein in a moderately strong solution of caustic potash, and adding acetic acid, when it will be separated in the form of a gelatinous, translucent precipitate. It is the same, from whichever of the above ingredients it may be obtained, and is supposed to form the basis of all the tissues; hence the name. It combines with oxygen in definite proportions, forming a binoxide and tritoxide, which are formed in the lungs from fibrin; the fibrin in the blood in this way acting as a carrier of oxygen to the tissues. In inflammations, a much larger quantity of oxidized protein is contained in the blood than exists in health, which gives rise to the buffy coat. Its formula is, $C_{36}H_{50}N_8O_{10}$. The existence of this substance as a distinct organic element, has been denied by Liebig and Fleitmann, while it is maintained by Mulder.

Albumen, *fibrin*, and *casein* are modifications of this element formed by combination with a small quantity of phosphorus, or of sulphur, or both.

Albumen is found either liquid or concrete: liquid, in the white of egg, serum of the blood, chyle, lymph, and in some of the secretions; solid in the brain, spinal cord, nerves, &c. Heat, acids, and corrosive sublimate coagulate it. The kidneys somtimes in a diseased state secrete it.

Fibrin exists in chyle, lymph, blood, and muscle, and is an abundant and important animal principle. It may be procured by beating blood with a rod, to which it will adhere in filaments. It is solid, white, flxible, elastic, insipid, inodorous, and heavier than water. It constitutes the buffy coat of the blood, is secreted in inflammation, and called coagulable lymph; has the property of self-coagulation, is the cause of the coagulation of the blood, and possesses a higher degree of organizability than albumen. The fibrin in arterial blood is more highly oxidized than that in the venous. Chemically, fibrin and albumen cannot be distinguished.*

Casein exists abundantly in milk, and is the basis of cheese, is found also in blood, saliva, pancreatic juice, pus, &c. It is obtained by coagulating milk, washing the coagulum, and drying it. It contains sulphur, but no phosphorus.

* Much yet remains to be settled respecting what are termed the *protein compounds*.

Globulin of the blood-corpuscles has also been placed by some among the protein compounds.

Pepsin has also been classed with them, and possesses many properties of albumen. Liebig doubts its existence as a distinct compound. It has been regarded by Mulder as a *protoxide of protein.*

Gelatin is the chief ingredient of cellular tissue, skin, tendons, ligaments, and cartilage; it is found also in other structures. It is obtained by boiling substances containing it, clarifying, concentrating, and drying the solution. It is known in commerce by the names *glue, isinglass, portable soup*, &c. Tannin precipitates it from its solution, and is the appropriate test.

Chondrin is obtained by boiling the cornea, permanent cartilages and bones before ossification. It resembles gelatin.

Osmazome exists in the muscles, blood, and brain; it gives flavor to soups, and is nutritive and stimulating.

Mucus is a fluid secreted by mucous surfaces for their protection.

Urea exists in the urine of mammalia in health. It is derived from the decomposition of the tissues in the process of nutrition.

Uric or *lithic acid* is found in the urine of man, birds, serpents, &c. In the herbivora, it is replaced by the hippuric acid.

Hematin, or *hematosin*, is the red coloring principle of the blood, which, it has been supposed, may depend upon the sulphocyanite of iron. It is contained in a capsule which is composed of *globulin.*

What are those which do not contain nitrogen? Olein, stearin, fatty matter of the brain and nerves; acetic acid; oxalic acid; benzoic acid; lactic acid; sugar of milk; sugar of diabetes; bilin or picromel; cholesterin; and biliverdin.

Olein or *Elain*, and *Stearin*, are found in fixed oils united with glycerin. Olein gives fluidity, and stearin the solid elements of fatty matter.

Margarin is also a constituent of fat.

In what forms are the component parts of the animal body found? *Solids* and *fluids.*

What are the *solids* of the human body? *Bone, cartilage, muscles, ligaments, vessels, nerves, ganglions, follicles,* or *crypts, glands, membranes, areolar, cellular,* or *laminated tissue,* and *viscus;* this last is the most complex in the human

body, and is the name given to organs contained in the splanchnic cavities.

How are *membranes* divided? Into simple and compound.

What are the *simple* membranes? The *serous, mucous,* and *fibrous.*

What are the *compound* membranes? They are the *fibro-serous, sero-mucous,* and *fibro-mucous.*

What are the *primary tissues* or *anatomical elements?* The *cellular* or *laminated fibre* or *tissue;* the *muscular fibre* or *tissue;* and the *nervous, pulpy,* or *medullary fibre* or *tissue;* to which another has been added by Chaussier, called the *albugineous.* These tissues, by uniting differently, form the first order of solids, and these again by union give rise to compound solids, from which the different organs, bones, glands, &c., are formed. The tissues are differently classified by different authors.

What are the textures and other organized constituents of the body? *Blood, chyle,* and *lymph. Epidermic* tissue, including *epithelium, cuticle, nails,* and *hairs. Pigment. Adipose tissue. Cellular (areolar tissue). Fibrous tissue. Elastic tissue. Cartilage. Bone* or *osseous tissue. Muscular tissue. Nervous tissue. Bloodvessels. Absorbent vessels* and *glands. Serous and Synovial membranes. Mucous membranes. Skin. Secreting glands.*

In what way are the solids arranged to form the different structures? In *filaments* or *elementary fibres, tissues, organs, apparatuses,* and *systems.*

What is meant by a *fibre?* A number of filaments united together. It is sometimes called a *tissue,* but this term is usually applied to a particular arrangement of fibres. An *organ* is a compound of several tissues. An *apparatus* is an assemblage of organs tending to the same end, as the *digestive apparatus,* which is formed by a variety of organs of a dissimilar kind. A *system* is an assemblage of organs possessing the same or an analogous structure. For example, all the muscles of the body have a common structure, and, taken as a whole, constitute the *muscular system.* The same with the vessels and nerves, which, taken collectively, constitute the *vascular* and *nervous* systems.

What proportion do the fluids of the body bear to the whole weight? It is not easy to estimate the proportion, as it varies at

different times and periods of life; the younger the animal, the greater the preponderance of the fluids.

How have the fluids of the body been classified? Into five classes: 1, those produced by the act of digestion, the *chyme* and the *chyle;* 2, the circulating fluids, the *lymph* and the *blood;* 3, the *perspired fluids;* 4, the *follicular;* and 5, the *glandular.*—*Chaussier.*

What are the *physical properties* of the tissues? *Flexibility, extensibility, elasticity,* and *porosity.*

Elasticity is the property which causes a tissue to react upon the withdrawal of a stretching or compressing force.

We have examples of this property in the yellow ligaments, in the middle coats of the arteries, &c.

Extensibility is possessed by elastic tissues; but some tissues, as the fibrous, will yield to a slow continued distending force, that are not elastic.

Flexibility may exist without elasticity or extensibility, as in tendons.

Porosity is the property of permeability by fluids, possessed by tissues after death as well as during life; the term *imbibition* has also been given to this property. This property gives rise, under certain circumstances, to the phenomena termed *endosmose* and *exosmose.*

If we take a glass or other tube, closed at one end by a piece of bladder or membrane, and place in it a solution of salt or sugar, we find that the solution permeates the pores of the membrane, but does not pass through it. If we then immerse the lower end of the tube in pure water, it is found to rise within the tube, sometimes to a considerable extent; while, at the same time, a portion of the solution in the tube has passed into the water. In this phenomena, the current from *without* to *within* is called *endosmose*, while the current from *within* to *without* is called *exosmose.*

The circumstances necessary for the success of this experiment are, that an *affinity* must exist between the fluids and the membrane; the fluids must be *miscible* with each other, and of *different densities.* As a general rule, the current is the most rapid from the rarer to the denser medium, and continues until their density is equalized.

This property is purely physical, an l not peculiar to organized

structures; plates of slate, baked clay, and some wire textures will exhibit it.

Albumen, of all soluble organic substances, facilitates endosmose with the greatest force.

No satisfactory explanation has yet been given of this physical law. The current is usually the most rapid from the rarer to the denser fluid, yet this is not always the case; it is determined by the affinity between the liquid and the dividing substance; and is from the liquid having the greatest affinity to the opposite side. Many phenomena, usually looked upon as vital, can be explained by this property, in physiology, pathology, and therapeutics.

Gases are also subject to the same law, in respect to this property, that liquids are; and this double current takes place in the lungs during the act of respiration, through the walls of the pulmonary air-cells, and the minutely ramified capillaries on them.

What is understood by the *vital properties of the tissues?* They are those belonging only to *living* organized products, and are found in muscular and nervous structures.

The vital property of muscle is *contractility*, and is characteristic of that tissue. The vital property of nervous structure is manifested in three ways: *first*, by inducing contraction in the muscle supplied by it; *secondly*, by exciting contractions in muscles not supplied by it, through a change produced in the nervous centre; *thirdly*, by exciting sensation.

All organized beings do not possess the properties of contractility and sensibility. Vegetables have no nervous system, and therefore the function of sensibility is wanting; although they have *irritability* or *excitability* developed, which may be considered to be the vital property common to all organized bodies.

Functions of Man.

How are the functions of man classified? Into three classes: *First.* The *Animal*, or those of *Relation*. *Second*. The *Nutritive*. *Third*. The *Reproductive*.

What is included under the first of these divisions? *Sensibility* and *muscular motion*, including *expression* or *language*.

What under the second? *Digestion, absorption, respiration, circulation, nutrition, calorification,* and *secretion.*

What under the third? *Generation.*

What are the forces which preside over the various functions? They are either *general* or *special;* the former are *physical* or *chemical,* and the latter *organic* or *vital.* Some organs are examples of purely mechanical arrangements, as the eye, organ of voice, the ear, and the circulatory apparatus, arrangements for endosmose and exosmose, &c. In many functions, chemical agency performs an important part also; while others cannot be explained on these principles, and are termed *vital.* Many functions are performed through a combination of these forces.

Animal Functions, or Functions of Relation.

What is understood by *Sensibility?* It is the function by which the animal experiences feeling, or has the perception of an impression. It has also been applied to the property of living parts of receiving impressions; whether attended by consciousness or not of the individual upon whom the impression is made. We, therefore, where there is consciousness, have *animal* sensibility; and where there is none, it is termed *organic* sensibility.

By what apparatus is it that animal sensibility is effected? The whole nervous system is concerned in it.

What is included in what is called the *Nervous System?* It consists of three portions: first, the *cerebro-spinal axis;* secondly, of *cords* called *nerves;* and thirdly, of a nervous cord situated on each side of the spine from the head to the pelvis, forming *ganglia* opposite each vertebral foramen, and called the *great sympathetic.*

What is Dr. Marshall Hall's division of the nerves? Into, 1. The *cerebral,* or the *sentient* and *voluntary.* 2. The *true spinal,* or *excito-motory.* 3. The *ganglionic,* or the *nutrient* and *secretory.*

The first of these receives impressions which are conveyed by *afferent* nerves to the brain, and produce a mental impression. As a result of this, a motor impulse may be transmitted along the *efferent* nerves to particular muscles which are excited to contrac-

tion. The encephalon and nerves communicating with it are the organs for these functions.

The second portion may receive impressions which are propagated along *afferent* fibres to ganglionic centres distinct from the sensorium, in which a reflex motor influence is excited, that is transmitted along *efferent* trunks connected with these centres, and excite muscular contraction, without the necessary intervention of sensation and volition. The organs for this function are the gray matter of the spinal cord, and the nerves connected with it.

The office performed by a nerve depends upon its connections, *central* and *peripheral*, and may be ascertained by an examination of these connections. If it lose itself entirely in the substance of muscles, we infer it is efferent or motor; if on a membranous expansion, that it is afferent or sensory; if on a surface adapted to receive special impressions only, it may be inferred that it is a nerve of special sensation.

The third division has for its object to combine and harmonize the muscular movements connected with organic life. It influences the functions of nutrition, secretion, &c., also. Much remains yet to be learned respecting the physiology of the nervous system.

What phenomena are included under the term sensibility? The *sensations*, properly so called, and the *intellectual and moral manifestations.*

What is meant by a *sensation?* It is the perception of an impression made on an organ; it is by this means that we receive a knowledge of what is passing around and within us; and from which result *thought* and *judgment.*

How are the sensations divided? Into *external* and *internal.* Vision and audition are examples of the external, and hunger and thirst of the internal.

Is the encephalon necessary to sensation? It is. The impression must be made on a distant organ and communicated to the encephalon, before sensation is effected.

How may this be proved? By cutting or putting a ligature around a nerve proceeding to any sensible part; or, if the brain be prevented from acting in any way, there will be no sensation.

Has the condition of the mind anything to do with sensation? It has.

Is every part of the human body subject to sensibility? It is, either in health or disease, if we except perhaps the cuticle.

In what part of the brain are the cerebral organs of the senses placed? That portion between the corpora quadrigemina and the medulla oblongata, including these parts; and it is with this part of the brain that the nerves of the senses are found to communicate.

What would be the effect of dividing the posterior roots of the spinal nerves and of the fifth pair? All *general* sensibility would be lost; but, if we divide the nerves of the senses, *their* functions only are destroyed.

In what manner is this transmission along the nervous cords and spinal marrow effected? We are unacquainted with the *material* character of the nervous fluid or influence which passes along the nerves with such rapidity; and we are aware of such transmission only by the results. Whether it is *animal spirits* secreted by the brain and transmitted along the nerves under the name of *nervous fluid*, or whether effected by *vibrations* or *oscillations* of the nervous cords, or whether it is produced by the operation of *animal electricity* or an *electroid* or *galvanoid* fluid, we will not attempt to determine. This last explanation is perhaps the most popular one at present.

External Sensations.

What are the external sensations? They are those perceptions that are occasioned by the impressions of bodies external to the part impressed.

How are they divided? Into the *senses* properly so called, by which the different qualities of external bodies are ascertained; and those sensations which are caused by contact, but afford no information to the mind. The external senses are the organs by which we become acquainted with bodies that surround us.

What are the external senses? *Tact or touch, taste, smell, hearing, and vision.* They all consist of two parts—*physical*, or that which modifies the action of the body which causes the impression; and *nervous* or *vital*, which receives the impression, and conveys it to the brain.

The senses may be exercised in two modes: *actively*, by direct-

ing the attention; and *passively*, when impressions are received without the mind being specially directed to them.

The active exercise gives increased delicacy and vigor; yet this must not be too constant, or too intense, or injury may result. We may also deaden a sensation by voluntarily diminishing the amount of stimulus applied to the sentient organ. The loss of one sense is usually attended by an increase of acuteness in those remaining; but this undoubtedly arises from their superior education.

The senses are all modifications of that of *tact* or *touch;* the sapid body, the odorous particles, the sonorous vibrations, and the light, must impinge upon or touch the nervous position of the organ, before sensation can be effected.

Sense of Tact or Touch.—Palpation.

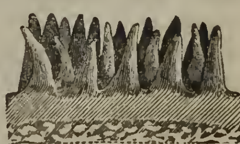
What is meant by the sense of tact or touch? It is the general feeling or sensibility; and is more extensively diffused than any of the other senses.

Is there any difference between tact and touch? The sense of tact is spread generally in the organs; and especially in the cutaneous and mucous surfaces: touch is tact joined to muscular contraction, and directed by volition;—so that the exercise of tact may be considered as *passive;* and that of touch *active.*

What is the chief organ of touch? The skin, which is supplied by nerves from the posterior roots of the spinal nerves, and from a portion of the fifth and eighth pair of cerebral nerves, and are the same as those of general sensation. They are distributed to the tactile papillæ, which are small elevations enclosing loops of blood-vessels and branches of a sensitive nerve, situated on the exterior surface of the cutis vera, and covered by the cuticle, which serves as a protection to the papillæ.

The cut (Fig. 1) represents several of these papillæ of the palm of the hand, with the cuticle detached. They are magnified 35 diameters.

Fig. 1.



The acuteness of this sense in different parts, is in proportion to the amount of sensory nerves distributed to them, and the education of the part. Contact of the body with the sensory surface is necessary to the exercise of this function.

What conditions are necessary to the exercise of this sense? Merely that the substance which causes it shall be brought in contact with the physical part of the organ — the cuticle.

Are all the layers of the skin necessary to touch? Every layer appears to have an appropriate office to perform in the exercise of this function.

By what sense are we enabled to form an idea of the temperature of bodies? The sense of tact or touch.

Does it always give us a correct impression? Not always, as it is very much influenced by the previously surrounding temperature, habit, &c.

Is this considered to be one of the most certain of the senses? It is, perhaps, the least subject to error of all the senses. Some have called it the *regulating*, the *geometrical* sense; but this is giving it too high a position. It is capable of extraordinary acuteness and certainty by education, as in the case of blind persons.

Where is the most delicate organ of touch situated? In man and monkeys, in the hand. In most quadrupeds, in the lips, snout, or proboscis; in molluscous animals, in the tentacula; and in insects, in the antennæ.

Sense of Taste, or Gustation.

What is the object of the sense of taste? It teaches us the quality of bodies called *sapidity*.

Is the organ of taste capable of receiving other impressions than those of taste? It also possesses the power of touch, and one of these properties may be lost while the other remains; and neither one can supply the place of the other.

What is the chief organ of taste? The tongue. The lips, inner surface of the cheeks, palate, and fauces also participate in this function. The mucous membrane of the tongue is highly organized, and the papillæ, or proper organs of taste, are very numerous.

What circumstances are necessary that this function may be satisfactorily exercised? The mucous membrane of the mouth should be in a state of integrity, the fluids poured into it should exist in proper quantity and quality, and the substance to be tasted should be soluble. It is improved also by bringing the tongue in contact with the palate.

What nerves are distributed to the tongue? The ninth pair;

the lingual, and other branches of the fifth pair; and the glosso-pharyngeal.

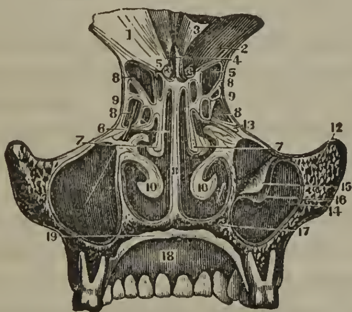
Which of these is supposed to be the nerve of taste? The lingual branch of the fifth pair.

Is this sense capable of cultivation? It is, in a very high degree.

Sense of Smell, or Olfaction.

What is the object of this sense? To appreciate the odorous properties of bodies. To do this, immediate contact of the odorous body is not necessary; an odorous emanation from it which shall impinge upon this organ of sense being sufficient.

Fig. 2.



For the anatomical description and references to this figure, see *Anatomy*, page 39.

What is the organ of smell? It is a mucous membrane which lines the nasal cavities or fossæ, called the *Schneiderian*, or *pituitary*.

What conditions must exist that the sense of smell may be duly exercised? The organ must be in a healthy condition, and the emanation from an odorous body must impinge upon the pituitary membrane with considerable force.

What is the ordinary medium for the transmission of odorous particles? The air.

In what mode is olfaction effected? In inspiration, the air charged with odorous particles comes in contact with the pituitary

membrane, through the medium of the nasal mucus, which arrests the odorous particles as they pass, and also keeps the parts properly lubricated. The olfactory nerve, being distributed on this membrane, receives the impressions of these particles, and in this manner the sensation is accomplished.

In what part of the olfactory organ does this sense reside in the highest degree? In the upper portion.

What nerves are distributed to the olfactory organs? A portion of the fifth pair, and the olfactory or first pair.

What is considered to be the proper nerve of this sense? The *olfactory*.

Is this sense capable of improvement by education? It is.

Sense of Hearing, or Audition.

What is the object of this sense? It makes known to us the peculiar vibrations of sonorous bodies, which constitute *sounds*.

How is the organ of hearing divided? Into three portions: 1, the *external ear*, or that exterior to the membrana tympani; 2, the *middle ear;* and 3, the *internal ear* itself, which contains the auditory nerve.

What office does the external ear perform in audition? It collects the sound, which it transmits to the membrana tympani through the meatus auditorius externus. To understand this properly, the laws regulating sound must be understood.

What is the function performed by the middle ear? The sonorous oscillations are received by the membrana tympani, and transmitted to the internal ear through the medium of the middle, in three ways: 1st, by the air contained in the cavity of the tympanum; 2dly, by the chain of bones to the membrane of the foramen ovale; and, 3dly, by the parietes of the tympanum; oscillations are, therefore, excited in the membranes of the foramen ovale and rotundum.

What are the uses of the *mastoid cells* in hearing? They are unknown.

What are the uses of the *ossicles* or *small bones* of the middle ear? They fulfil two functions: they conduct the vibrations from the membrana tympani; and also stretch or render more tense the membranes to which they are attached at their extremities.

What part does the *Eustachian tube* perform in audition? The integrity of this tube is essential to hearing, and its closure is followed by deafness; by it there is a maintenance of the equilibrium between the air within the tympanum and that without, so as to allow of the free action of the membrane, by preventing inordinate pressure and tension, which would be produced by too great or too little pressure on either side; the effect of which would be to impair the hearing. It has been supposed to be an avenue for sound to the internal ear; but this is very questionable. It is thought also to act as a diverticulum for the air in the cavity of the tympanum when it is agitated by too powerful sounds. It also serves the purpose of carrying into the pharynx any secretions of the tympanum, thereby preventing accumulation, and keeping it in a healthy condition.

What is the function of the internal ear in audition? The vibrations reach the internal ear, as has been shown, by which the membranes covering the foramen ovale and rotundum are thrown into vibrations, and communicate the impressions to the *liquor* of *Cotunnius*, which fills the cavities of the internal ear. The vibrations are then by this medium conducted to the auditory nerve, which receives the impressions and conveys them to the brain. Of the precise uses of the various beautiful parts of the internal ear, we are still ignorant.

What is the nerve of hearing? The *portio mollis* of the seventh pair; but it is necessary that the nerve of special sensibility, distributed to the part (which is a branch of the fifth pair), should be in a state of integrity, or the hearing will be impaired or destroyed.

Is this sense improved by education? It is greatly improved by cultivation.

What is the difference between *hearing* and *listening*? One may be termed *passive*, and the other *active* audition.

Of the Sense of Sight, or Vision.

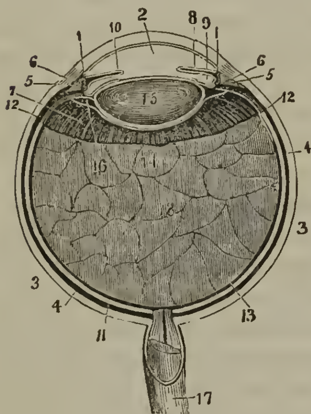
What is the object of this sense? It is to give us the notion of light and color.

What is the organ of vision? The eye and its accessory organs or tutamina.

Are any rays of light inservient to vision that fall on other parts of the eye than the retina ? No ; and it is only that portion falling on the cornea which passes through the pupil that can reach the retina, and affect the nerve of sight.

What are the changes that a ray of light undergoes in passing through the coats and humors of the eye ? When it strikes the cornea [1,2] obliquely, it is refracted towards the perpendicular, raised from the point of impact, because it passes into a denser medium. It is thereby rendered more convergent or approaches the axis of the cone. In passing through the aqueous humor,[9,10] little variation is produced, as it is of about the same density as the cornea. This convergence causes a greater number of rays to be collected towards, and enter the pupil, and of course to pass through the crystalline lens ; [15] which, being of increased density, the convergence is still more increased from the increased refractive power of the medium and the convexity of the lens. After the ray has passed the crystalline lens, it emerges into a rarer medium (the vitreous humor [18]), and is, therefore, refracted from the perpendicular ; but the shape of the posterior surface of the lens is such that the convergence is further increased, and meets the other rays at a focus on the retina,[11] and there presenting a picture or representation of the object on the retina in an inverted position.

Fig. 3.



To what is the *achromatic* property of the eye probably owing ? To the different refractive powers of the humors.

What is the use of the *Sclerotic* coat of the eye ? It gives form and protection to it.

What is the use of the *Choroid*[4] coat. It use is chiefly owing to the black pigment which lines and penetrates it. This *pigmentum nigrum* serves the purpose of absorbing the rays of light after they have passed through the retina, and by this means

obviating the confusion that would arise from varied reflections. It also serves as a defence against too strong light.

What is the use of the *Tapetum?* Its function is not fully settled; but M. Desmoulins is of the opinion that it acts the part of a mirror, and, by returning the rays of light through the retina, subjects it to a double contact.

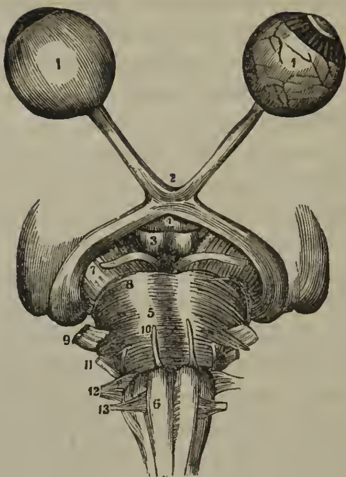
What is the use of the *Iris*[8] in vision? It acts the part of a diaphragm of a lens or telescope, and its function must be to correct the aberration of sphericity; which it does by diminishing the surface of the lens on which the rays impinge, so that they may meet at the same focus on the retina. It is capable of contracting or dilating, so as to contract or dilate the pupil. Its structure is supposed by some to be muscular, and by others vascular and nervous; the vessels and nerves being distributed on an erectile tissue. If muscular, it must consist of circular and radiated fibres, and the contraction of the pupil must be from the action of the circular fibres, while its dilatation is from the radiated. If it is erectile tissue, the dilatation and contraction are owing to the variation of the quantity of blood sent to the part. The motions of the iris appear to be very much under the influence of the optic nerve; for, if this nerve be divided, the pupil is rendered immovable and expanded. It also appears to be much influenced by the other nerves distributed to the eye. The exact agency of each over it does not seem to be well understood; but we find that it contracts or dilates according to the intensity of the light that strikes the eye. The sum of its uses is that it is partly the cause of the achromatism of the eye; that it corrects the aberration of sphericity; regulates the quantity of light admitted through the pupil, and accommodates the eye, to a certain extent, to vision at different distances.

What is the function of the *Retina*[1] (Fig. 4)? It is a nerve of special sensibility, and limited in its function to the appreciation of light.

Is it necessary to the perfection of its function that the nerve of general sensibility (a branch of the fifth pair), which is distributed to the parts, should be in a state of integrity? It is.

What are the uses of the *eyelids?* They preserve the eye in a moist state by nictation, regulate the quantity of light admitted to

Fig. 4.



the eye when too powerful or very weak, and preserve the eye from the contact and irritation of foreign matters.

What are the uses of the *muscles* of the eyeball? They serve to compress the ball, and give the proper direction to it for vision.

What are the uses of the *tears?* They moisten the conjunctiva, and serve to remove extraneous bodies from its surface.

What secretes the tears? The *lachrymal gland.*

Is the retina capable of visual impressions over its whole surface? It is; but the *point of distinct vision* is the central part of the retina, or that part in the direction of the axis of the eye. This point is readily discriminated on looking at a printed page, when it will be perceived that that part to which the axis of the eye is directed is alone sharply and distinctly seen; therefore the axis of the eye is changed as we wish to change our attention from one letter or word to another.

What conditions are necessary that the image of an object may impress the retina, and be perceived by the mind? It must occupy a space on the retina sufficiently large for its various parts to be appreciated; the image must be distinct or sharp, or, in other words, the luminous rays that form it must converge accurately to a focus on the retina; and the image must be sufficiently illuminated.

What angle must an object subtend to be visible? The sixtieth of a degree; but the visual power differs greatly in individuals.

Has the eye the power of accommodating itself to different distances in vision? It has; but upon what this depends is uncertain.

What connection between the nervous system and the eye is represented by Fig. 4? The optic nerves and chiasm,[2] corpora albicantia,[3] pons Varolii,[5] medulla oblongata,[7] and the origin of the third,[7] fourth,[8] fifth,[9] sixth,[10] seventh,[11] eighth,[12] and ninth[13] pairs of nerves.

Of Muscular Motion.

What are the objects of the function of muscular motion? To execute all the partial motions that are necessary for nutrition and reproduction, locomotion, &c. Sensibility and voluntary motion, strictly speaking, comprise the whole of the life of relation.

How is this function divided? Into *locomotility* and *expression*, or language.

What organs are essentially concerned in this function? The *encephalon*, the *spinal marrow*, the *nerves*, and the *muscles*.

Muscles have been termed the *active* organs of locomotion, in contra-distinction to the bones, tendons, and ligaments, which are *passive*.

Muscular tissue is of two kinds: the *striated* or *striped*, forming the muscles of animal life; and the *non-striated* or *unstriped*, forming the muscles of organic life.

Contractility is an inherent property of muscular fibre derived from its own structure, independent of the nervous system. There are two forms of contractility: one produces a *constant* tendency to shortening, independent of elasticity, and is termed *tonicity;* the other acts at intervals, and by the application of a stimulus, producing *active* contraction.

What is meant by *voluntary* motion? That which is effected by the muscular system of animal life, or by a contraction of the muscles under the influence of volition or the will.

To what part does the function of volition belong? To the encephalon — the influence of which is transmitted along the spinal marrow and nerves to the muscles.

Where is the seat of the nervous centre of muscular contraction? The encephalic organs concerned in muscular motion are the corpora striata, the thalami nervorum opticorum at their lower part, the crura cerebri, the pons Varolii, the peduncles of the cerebellum, the lateral parts of the medulla oblongata, and the anterior column of the medulla spinalis.

Do the same nervous fibres convey the power of muscular motion that give sensibility? No: they may be enveloped in the same neurilemma or sheath, but the fibres are different. In the case of the spinal marrow, the anterior column, and the nerves connected with it, are inservient to muscular motion; the posterior to sensibility; while the middle column, in the opinion of Sir Charles Bell, is the source of the respiratory nerves.

What are the phenomena of voluntary muscular contraction? The nervous influence emanates from some portion of the cerebro-spinal axis, and under the guidance of volition, proceeds along the nerves with immense rapidity, and excites the muscle to contraction. The muscle, from being smooth, becomes rugous, the belly more tumid, the ends approximate, and the whole organ is rendered thicker, firmer, and shorter.

It is generally believed by physiologists that the space occupied by a muscle during contraction, and the amount of blood in it at that time, are not increased, or the color altered. For a muscle to act, it is necessary that it possess a proper physical organization, and be also endowed with a vital property called *irritability* or *contractility*.

The nervous influx is the ordinary stimulus to contraction, although it may be excited by other stimulus. After a muscle has been in action for some time, repose is necessary, even if the nervous stimulus should be directed to it. Contractility remains after dissolution, but much longer in many of the lower orders of animals than in the higher orders. This may be proved by the application of stimuli to the muscles or nerves. Sometimes portions of the body move after death, without the application of stimuli, as is seen occasionally where persons have died from cholera. When contraction of a muscle takes place, a sensation instructs the mind of the fact; this has given rise to the idea of a *muscular sense*, by which we form ideas of force and resistance.

In what manner are the phenomena of muscular contraction

explained? It is essentially an organic and vital process, connected with an inherent property of muscular fibre, and different from any physical process with which we are acquainted; therefore, not to be explained by the ordinary properties and forces which operate upon matter.

Upon what does the *force* or *intensity* of *muscular contraction* depend? The physical condition of the muscle, and the energy of the brain.

Muscles of large, firm fibres will contract with more force than those with delicate loose fibres, the energy of the brain being the same; while, in instances of great cerebral excitement, muscles of delicate structure may be made to exceed those of firmer organization. It is, therefore, where the organization is firm and the excitement of the brain great, that we have the greatest intensity of muscular contraction. A muscle is capable of exerting its greatest degree of force when at its first degrees of contraction, or when nearly at its full length. Exercise, by improving the physical condition, increases the capacity to forcible muscular contraction.

The *duration* of muscular contraction is greater in voluntary than in involuntary muscles.

The *velocity* of muscular contraction differs according to the stimulus which sets it in motion. When excited by the will, it differs in obedience to this stimulus; and differs greatly by exercise, and in different animals.

The *extent* of muscular contraction is regulated by volition and the length of the muscle.

Is a combination of the actions of different muscles necessary in executing the various movements of the body? It is.

TABLE OF THE MUSCLES,

ARRANGED AFTER THE MANNER OF DR. BARCLAY, ACCORDING TO THEIR ACTIONS.

THE HEAD IS MOVED

Forwards by	*Backwards by*	*To either side by*
Platysma myoides,	Part of trapezius,	Platysma myoides,
Sterno-mastoideus,	Splenius capitis,	Sterno-mastoideus,
Rectus anticus major,	Complexus.	Part of trapezius,
" " minor,	Trachelo-mastoideus,	Splenius capitis,
Assisted (when the lower jaw is fixed) by	Rectus posticus major,	" colli,
Mylo-hyoideus,	" " minor,	Trachelo-mastoideus,
Genio-hyoideus,	Obliquus capitis superior.	Complexus.
Genio-hyoglossus,		
Digastrici.		

THE NECK IS MOVED

Forwards by

Platysma myoides,
Sterno-mastoideus,
Digastricus,
Mylo-hyoideus,
Genio-hyoideus,
Genio-hyoglossus,
Omo-hyoidei,
Sterno-hyoidei,
Thyro-hyoidei,
Rectus anticus minor,
Longus colli.

Backwards by

Part of trapezius,
Rhomboideus minor,
Serratus posticus superior,
Splenius capitis,
" colli,
Complexus,
Trachelo-mastoideus,
Traversalis colli,
Inter-spinalis colli,
Semi-spinalis colli,
Rectus posticus major,
" " minor,
Obliquus capitis superior,
" " inferior,
Scaleni postici,
Levator scapulæ.

Laterally by

Various combinations of those muscles which separately move it forwards and backwards, assisted by the scaleni, inter-transversalis, and recti laterales.

THE TRUNK IS MOVED

Forwards by

Rectus abdominis,
Pyramidalis,
Obliquus externus abdominis,
Obliquus internus,
Psoas magnus,
" parvus.

Assisted (when the arms are carried forwards) by

Pectoralis major,
" minor,
Serratus magnus.

Backwards by

Trapezius,
Rhomboideus major,
Latissimus dorsi,
Serratus posticus superior,
" " inferior,
Sacro-lumbalis,
Longissimus dorsi,
Spinales dorsi,
Semi-spinales dorsi,
Multifidus spinæ,
Inter-transversales dorsi et lumborum.

Laterally by

Obliquus externus,
" internus,
Quadratus lumborum,
Longissimus dorsi,
Sacro-lumbalis,
Serrati postici,
Latissimus dorsi.

THE SCAPULA IS MOVED

Upwards by

Trapezius,
Levator scapulæ,
Rhomboidei.

Downwards by

Lower part of trapezius,
Latissimus dorsi,
Pectoralis minor.

Forwards by

Pectoralis minor,
Serratus magnus.

Backwards by

Part of trapezius,
Rhomboidei,
Latissimus dorsi.

THE HUMERUS IS MOVED

Forwards by

Part of deltoid,
Part of pectoralis major,

Assisted in some circumstances by

Biceps,
Coraco-brachialis.

Backwards by

Part of deltoid,
Teres major,
" minor,
Long head of triceps,
Latissimus dorsi.

Inwards by

Part of pectoralis major,
Latissimus dorsi.

Rotated inwards by

Subscapularis.

Assisted occasionally by

Pectoralis major,
Latissimus and teres major.

Outwards by

Supra-spinatus,
Infra-spinatus,
Teres minor.

THE FOREARM IS MOVED

Forwards by

Biceps,
Brachialis anticus,
Pronator teres.

Assisted by

Flexor carpi radialis,
" sublimis,
" ulnaris,
Supinator longus.

Backwards by

Triceps,
Anconeus.

Rotated inwards by

Pronator teres,
Flexor carpi radialis,
Palmaris longus,
Flexor sublimis,
Pronator quadratus.

Outwards by

Biceps,
Supinator brevis.
Extensor secundi internodii.

THE CARPUS IS MOVED

Forwards by	*Backwards by*	*Outwards by*	*Inwards by*
Flexor carpi radialis, Palmaris longus, Flexor sublimis, Flexor carpi ulnaris, Flexor profundus, Flexor longus pollicis.	Extensor carpi radialis longior, Extensor carpi radialis brevior, Extensor secundi internodii, Indicator, Extensor communis digitorum, Extensor proprius pollicis.	Flexor carpi radialis, Extensor carpi radialis longior, Extensor carpi radialis brevior, Extensor ossis metacarpi, Extensor primi internodii.	Flexor sublimis, " carpi ulnaris, " profundus, Extensor communis digitorum, Extensor minimi digiti, Extensor carpi ulnaris.

THE THUMa IS MOVED

Inwards and forwads, across the palm, by	*Outwards and backwards by*	*Upwards and forwards, away from the other fingers, by*	*Backwards ana inwards, to the other fingers, by*
Opponens pollicis, Flexor brevis, " longus.	Extensor ossis metacarpi pollicis, Extensor primi internodii, Extensor secundi internodii.	Abductor, *Assisted by part of the* Flexor brevis.	Adductor, Extensor primi internodii, Extensor secundi internodii.

THE FINGERS ARE MOVED

Forwards, or flexed, by	*Backwards, or extended, by*	*Outwards, to radial border, by*	*Inwards by*
Flexor sublimis, " profundus, Lumbricales, Interossei, Flexor brevis digiti minimi, Abductor digiti minimi.	Extensor communis, Extensor minimi digiti, Indicator.	Abductor indicis, Abductor digiti minimi, Interossei.	Abductor digiti minimi, Interossei.

THE THIGH IS MOVED

Forwards by	*Backwards by*	*Inwards by*	*Outwards by*
Psoas magnus, Iliacus, Tensor vaginæ femoris, Pectineus, Adductor longus, " brevis.	Gluteus maximus, Part of gluteus medius, Pyriformis, Obturator internus, Part of adductor magnus, Long head of biceps, Semi-tendinosus, Semi-membranosus.	Psoas magnus, Iliacus, Pectineus, Gracilis, Adductor longus, " brevis, " magnus, Obturator externus, Quadratus femoris.	Tensor vaginæ femoris, Gluteus maximus, " medius, " minimus, Pyriformis.

THE THIGH IS ROTATED.

Inwards by	*Outwards by*
Tensor vaginæ femoris, Part of gluteus medius, *And, when the leg is extended, by* Sartorius, Semi-tendinosus.	Gluteus maximus, Part of gluteus medius, Pyriformis, Gemellus superior, Obturator internus, Gemellus inferior, Quadratus femoris, Obturator externus, Psoas magnus, Iliacus, Adductor longus, " brevis, " magnus Biceps cruris, slightly.

THE LEG IS MOVED

Backwards, or flexed, by	*Extended by*
Semi-tendinosus,	Rectus,
Biceps,	Crureus,
Semi-membranosus,	Vastus externus,
Gracilis,	" internus.
Sartorius,	
Popliteus.	

THE FOOT IS MOVED

Forwards, or flexed, by	*Backwards, or extended, by*	*Inclined inwards by*	*Outwards by*
Tibialis anticus,	Gastrocnemius,	Extensor proprius pollicis,	Peroneus longus,
Extensor proprius pollicis,	Plantaris,	Flexor longus digitorum,	" brevis,
Extensor longus digitorum,	Soleus,	Flexor longus pollicis,	Extensor longus digitorum,
Peroneus tertius.	Flexor longus digitorum,	Tibialis posticus.	Peroneus tertius.
	Flexor longus pollicis,		
	Tibialis posticus,		
	Peroneus longus,		
	" brevis.		

THE TOES ARE MOVED

Backwards, or flexed, by	*Forwards, or extended, by*	*Inclined inwards by*	*Outwards by*
Abductor pollicis,	Extensor longus digitorum,	Abductor pollicis,	Adductor pollicis,
Flexor brevis digitorum,	Extensor proprius pollicis,	Interossei.	Adductor digiti minimi,
Abductor minimi digiti,	Extensor brevis digitorum.		Interossei.*
Flexor longus pollicis,			
Flexor digitorum,			
Flexor accessorius,			
Lumbricales,			
Flexor brevis pollicis,			
Adductor pollicis,			
Flexor brevis minimi digiti,			
Interossei.			

What are the *Attitudes* which man is capable of assuming? They are divided into the *active* and the *passive:* the former require a muscular effort; the latter do not, as when the body lies in a horizontal position.

Does the attitude of *standing* require muscular effort? It requires the action of the extensors.

How are the *Movements* of the body divided? Into *partial* and *locomotive;* the former simply changes the relative situation of

* Quain's Human Anatomy, by Quain and Sharpey, Amer. edit. by Leidy, i 465, Philadelphia, 1849.

parts of the body, and the latter the relation of the whole body to the soil.

What are the *Locomotive* movements? *Walking, leaping, running, swimming, flying,* &c.

Of the Function of Expression, or of Language.

What is included under this head? Those varieties of muscular contraction by which man and animals exhibit their feelings, and communicate the knowledge of such feelings to each other; and comprises two different sets of actions.

What are they? Those addressed to the ear, producing the phenomena of *voice;* and those appreciated by sight and by touch — or the *gestures.*

What is meant by the *Voice,* or *Phonation?* It is the sound produced in the larynx while the air is passing through it.

The modifications by which speech is produced are effected in the cavity of the mouth and in the fauces.

What *organs* are concerned in the production of the voice? The muscles concerned in respiration, the larynx, the mouth, and nasal fossæ

What are the *conditions* necessary to the production of the voice? That air shall be sent from the lungs through the glottis, where it may throw certain parts into vibration, and then make its exit by the mouth and nasal fossæ; volition is, however, also required to cause the necessary action of the muscles of the larynx for its production and modification.

What are the *evidences* that the voice is produced in the larynx? One is that, if an opening is made below the larynx, the voice is lost; another is, that the voice of an animal may be produced, or a resemblance to it, by forcing the air into the tracheal extremity towards the larynx, provided we approximate the arytenoid cartilages; but if this is not done, no voice is produced by the air in passing. Also, if the muscles moving these parts are paralyzed from any cause, the voice is lost.

What *nerves* preside over the muscles concerned in the formation of the voice? The superior and inferior laryngeal nerves, the last of which is called recurrent.

By what *portion* of the larynx is the voice produced? The *infe-*

rior ligaments, which vibrate distinctly during the production of the voice, and upon which it evidently depends. These ligaments are, therefore, essentially the organs of voice, and are called the *chordæ vocales*. They are operated upon, and modified in their action, by the muscles appropriate for that purpose.

The respective actions of the different muscles are as follows:—

Govern the Pitch of the Notes.

Antagonists.	Crico-thyroidei, Sterno-thyroidei	Depress the front of the thyroid cartilage on the cricoid, and *stretch* the vocal ligaments; assisted by the arytenoideus and crico-arytenoidei postici.
	Thyro-arytenoidei, Thyro-hyoidei	Elevate the front of the thyroid, and draw it towards the arytenoid, *relaxing* the vocal ligaments.

Govern the Aperture of the Glottis

Antagonists.	Crico-arytenoidei postici	*Open* the glottis.
	Crico-arytenoidei laterales, Arytenoideus	Press together the inner edges of the arytenoid cartilage, and *close* the glottis.*

Those only which relax or stretch these ligaments are concerned in the production of the voice.

The *intensity* or *volume* of the voice depends mainly upon the force with which the air is sent from the lungs, and the size of the larynx. The difference between the male and female voice depends essentially upon the difference in the size of the larynx. The different notes are produced by different degrees of tension of the chordæ vocales, or ligaments.

The *timbre* or *quality* of the voice depends upon the condition of the cartilages of the larynx, and the aptitudes of parts of the organ for vibration, depending upon a variety of circumstances connected with the larynx and accessory parts.

Ciliary Motion.

What is understood by *ciliary* or *vibratory* motion? Cilia, *b*, are little hair-like processes which cover some forms of epithelium, *a*, and are visible by the aid of a microscope. These cilia have the the property of moving or being moved, resembling, when in motion, a field of wheat over which the wind is blowing, first depressed,

Fig. 5.

* Dunglison's Physiology, 7th edition.

and then returning to its original state. It is of great importance in the animal economy. They move towards the outlets, and propel the secretions in that direction.

The *cause* producing this motion is not known; it seems to be *molecular*, and independent of the vital condition and stimuli affecting it, such as narcotics, electricity, &c.

Nutritive Functions.

What are the nutritive functions? Digestion, absorption, respiration, circulation, nutrition, calorification, and secretion — seven in number.

What is effected by these functions? The composition and decomposition of the body.

Digestion.

What is digestion? It is that process to which food is subjected so as to render the nutritive portion of it fit for absorption.

What are the digestive organs? They consist of a long canal of variable dimensions at its different parts, and communicating externally by two openings — the mouth and the anus.

What is meant by *food* or *aliment?* All substances which, when received into the digestive organs, are capable of being converted into chyle.

How are animals characterized from the food upon which they subsist? The *carnivorous*, or those feeding on flesh; the *piscivorous*, on fish; the *insectivorous*, on insects; the *phytivorous*, on vegetables; the *granivorous*, on seeds; the *frugivorous*, on fruits; the *graminivorous* and *herbivorous*, on the grasses; and the *omnivorous*, on both animal and vegetable food.

To which of these does the digestive apparatus of man belong? Intermediate between the carnivorous and herbivorous; it is, therefore, *omnivorous*, although he is capable of living on either vegetable or animal diet, to the exclusion of the other; but when confined to one alone from infancy, the corporeal and mental development is generally inferior to that produced by a mixed diet of vegetables and animals.

Will man or animals thrive and live when restricted to any single

article of diet? They will not for any considerable length of time; a variety, whether animal or vegetable, or both, appears to be necessary to health. (For references to this figure, see *Anatomy*, pages 74, 75.)

Fig. 6.

What is the division of aliments proposed by Dr. Pereira? The *Aqueous*, *Mucilaginous* or *Gummy*, *Saccharine*, *Amylaceous*, *Ligneous*, *Pectinaceous*, *Acidulous*, *Alcoholic*, *Oily* or *Fatty*, *Proteinaceous*, *Gelatinous*, and *Saline*. From these *simple* aliments our *compound* aliments are formed.

What forms the basis of all drinks? Water.

How are drinks classified by Dr. Pereira?

1. *Mucilaginous*, *farinaceous*, or *saccharine* drinks.

2. *Aromatic* or *astringent* drinks.
3. *Acidulous* drinks.
4. Animal broths, or drinks containing *gelatine* and *osmazome*
5. *Emulsive* or *milky* drinks.
6. *Alcoholic* and other *intoxicating* drinks.

Liebig divides aliments into *azotized* and *non-azotized.* He considers the azotized to be for the nutrition and reparation of the animal tissues; hence he calls them "*plastic elements of nutrition.*" The non-azotized are designed to supply the materials for animal heat and respiration, hence called "*elements of respiration.*" It has been proposed to call the first *nutritive elements,* and the latter *calorifacient.*

What is understood by a *Condiment?* A substance which promotes digestion, and is taken with food for that purpose; and also sometimes adds to its sapidity.

What are the different parts of the digestive operation? *Hunger, prehension of food, Oral* or *Buccal digestion* or *mastication, Deglutition, Chymification,* the *Action of the Small Intestine,* the *Action of the Large Intestine,* and *Defecation,* or *the Expulsion of the feces.* The first six of these belong to the formation of chyle: the others relate to the excrementitious portions of the food. The digestion of solids requires all these processes: that of liquids comprises only thirst, prehension, deglutition, the action of the stomach, and of the small intestine.

What is *Hunger?* It is an internal sensation, the seat of which is invariably referred to the stomach, and proceeds from changes in this organ. It indicates the want of solid aliment.

Thirst indicates the want of a liquid.

What are the general effects of hunger on the system. Debility and diminished action of every organ, except, perhaps, of the absorbents, which are supposed to be increased.

From what source are the nerves of the stomach derived? The eighth pair and the great sympathetic; but to which of these the sensation of hunger is referable is not clearly settled.

What are the organs of *Prehension* of *Food?* The arms and the mouth.

What changes are effected upon the food in the mouth? The principal is *Mastication,* by which the food is prepared by minute division for the action of the solvent. This mechanical disintegra-

tion is materially aided by *Insalivation*, while, at the same time, the saliva changes the chemical composition of the mass. The reaction of this fluid is alkaline (dependent upon the basic phosphate of soda), varying at different times, being the greatest during and after meals. The substance upon which the peculiar properties of saliva depends is termed *Ptyalin*, an albuminous compound which acts the part of a "ferment:" *Sulphocyanogen* is also uniformly present. This fluid is made up from the secretions of the buccal and salivary glands. The products of the different salivary glands have different degrees of efficacy in this part of the digestive process; and the quantity is estimated at about three and a half pounds daily. The saliva exerts a chemical action on the farinaceous elements of food by changing starch or dextrine into grape sugar, while no action is exerted upon nitrogenous compounds.

What organs are brought into action in *Deglutition?* The mouth, pharynx, and œsophagus. It has been divided into three stages: in the first, the food passes from the mouth into the pharynx; in the second, it clears the aperture of the glottis and nasal fossæ, and attains the œsophagus; in the third, it clears the œsophagus and enters the stomach.

What are the nerves distributed to these parts? The glosso-pharyngeal to the mucous surface of the tongue and fauces, and is the excitor nerve; and the pharyngeal branches of the pneumogastric are the motors; there are also some branches of the fifth pair, which may be considered as associate excitor nerves; and the associate motors are branches of the hypoglossal.

What is meant by *Chymification?* It is that part of the true digestive action by which food is converted into a pultaceous mass, termed chyme, and is exclusively a gastric act.

What changes occur in the stomach after food is swallowed? The mucous membrane becomes florid; the different secretions take place in greater abundance, and become mixed with the food. After some interval, longer in some cases than in others, the pyloric portion contracts, which sends the food into the splenic portion, then it dilates, and this alternation goes on during the whole time of digestion, and is called *peristole;* it is limited at first to the pyloric portion, but at length it is extended to the other portions, so that the whole stomach participates in this kind of movement. This movement, which is produced by alternate

contraction and relaxation of the circular fibres of the stomach, facilitates the admixture of the food with its secretions. The operations performed, therefore, in the stomach, are the gentle oscillatory or vermicular motions, and the admixture of the food with the different secretions of the stomach and upper portion of the alimentary canal, which are the principal agents of the digestion performed in the stomach.

What is the nature of the process of *Gastric Digestion?* The principal agent is the *Gastric Juice*, which is secreted by the peptic follicles; it is a clear, transparent, colorless, or slightly yellow fluid, with very little viscidity. It is decidedly acid; but, with regard to the nature of this acid, there is a discrepancy among chemists. Bernard, Thomson, Lehman, Smith of Philadelphia, and others, affirm that it is *Lactic* acid. Hydrochloric acid has also been detected, and they *may* both be present and contribute to its solvent power. Other acids have also been detected, but can hardly be considered as its normal constituents. The peculiar organic ferment of this fluid is *Pepsin*, which combines with many acids; and, when in union with acetic and muriatic acids, its solvent power is increased. The quantity secreted depends rather upon the general requirements of the system than upon the quantity of food introduced into the stomach. A *definite proportion* only of aliment can be perfectly digested in a given quantity of fluid, and, should the former be in excess, it will remain in the stomach or pass into the bowels in a crude state, and produce disease of some kind or other. The condition of the nervous system, and the state of integrity of the pneumogastric nerve, influence greatly the production of this fluid, and therefore decidedly affect the digestive process. It is the principal agent, therefore, by which *chemical solution* and *reduction* of the food are effected, and *Chyme* is formed.

This liquid (the chyme) is of a pultaceous consistence, but varies greatly in its composition and appearance, according to the proportion of the different elementary substances entering into the composition of the food, always, however, having a strong acid reaction.

Azotized substances are *dissolved* by the gastric juice, while no action is exerted upon *starchy*, *saccharine*, or *oleaginous* matters. Any change which may take place in the starchy particles in the

stomach is entirely dependent upon the presence of the salivary fluid. *Oleaginous* matters are merely *reduced* to a state of minute division, and are diffused in a state of suspension through the chyme. *Albuminous matters*, or the *Protein compounds*, are completely dissolved, their chemical properties are altered, and they are brought into one uniform condition, that of *albuminose*, which is a state best adapted for subsequent assimilation. In this condition they seem to form definite combinations with the solvent fluids which have received the name of *peptones*. In this process the *converting* power is exerted by the pepsin, while the *solvent* power is due to the acid.

The solvent power of the gastric juice is influenced by *temperature;* it requires a heat from 96° to 100°, and is retarded if reduced below this point; and if raised above it the gastric juice is decomposed and its solvent power destroyed. It is also influenced by *motion;* by the *removal of the matters already reduced or dissolved*, which may be done by absorption in part, and also by the escape of the reduced portions through the pyloric orifice; and by the state of *minute division and incorporation with aqueous fluid.*

The *Chyme*, or product of gastric digestion, contains matters in *solution*, and also much that is only *reduced* and mechanically *suspended;* the solution progresses somewhat after it has passed into the intestinal tube. Digestion, therefore, is not completed in the stomach, but only advanced. The time occupied in this portion of digestion varies very much, depending upon the kind of diet used; but three or four hours is probably about an average.

What is the nature of the process of *Intestinal Digestion?* Soon after the chyme enters the duodenum it is subjected to the action of the bile, the pancreatic fluid, and the secretion from the glandulæ in the walls of the intestine itself (proceeding chiefly perhaps from the glands of Brunner), which is called *Succus Entericus.*

The pancreas resembles the salivary glands, and its secretion strongly resembles the saliva in its general appearance; it is clear, colorless, slightly viscid, and alkaline; but the nature of its animal principle is not precisely the same, although it is also capable of converting starch into sugar, and therefore subservient to the continued digestion of the farinaceous part of food during its passage through the small intestines; which power, however, is shared by

the *succus entericus*. According to M. Bernard, the essential purposes of the pancreatic fluid is to promote the absorption of fatty matters, by reducing them to an *emulsion* which is capable of finding its way into the lacteals.

The *Biliary* secretion is also received into the duodenum, but its exact agency in the process of digestion is not well understood. It is ascertained, however, that it has the effect of checking destructive chemical changes in the chyme; fermentation and acidity in the alimentary canal is thus prevented. It also promotes peristaltic action; but animals may live for a long time where the bile is carried off from the system artificially, although they will in time die from inanition.

The *Succus Entericus* is a colorless, viscid liquid, invariably alkaline in its reactions. It has the remarkable property of exerting a solvent action on albuminous bodies, scarcely inferior to the gastric juice, and also the power of converting starch into sugar in nearly an equal degree with the saliva and pancreatic fluid. The fluid of the small intestines, compounded of these different secretions, possesses the peculiar power of dissolving, or of reducing to an absorbable condition, alimentary substances of every class, a property possessed by neither of the fluids composing it, separately. It completes the conversion of starchy into saccharine matter, it emulsifies oleaginous matters, redissolves albuminous compounds which have been precipitated by the admixture of bile, and completes the solution of this class of substances which have been imperfectly dissolved in the stomach. It is therefore enabled to complete the preparation of all the compounds called for by the varied wants of the system. The processes of digestion and conversion are probably continued during the entire passage of the aliments along the intestinal canal, while the products are gradually being withdrawn by the action of the absorbents, so that, by the time the mass reaches the cœcum, little remains except the innutritious and insoluble portions of the food, together with the excrementitious parts of the bile and other secretions. The contents of the intestine are alkaline until they arrive at the cœcum, when they become acid.

What is the office of the *Large Intestine?* It acts as a reservoir and excretory canal for the feces.

Where is the fecal matter formed, and what does it consist of?

in the large intestine, and consists of the excrementitious part of the food, as well as of the juices of the upper part of the canal, which have been subjected to the digestive process; of the secretions poured out from the lower part of the intestines; and of the substances which have escaped the digestive action of the stomach and small intestine. The chemical composition varies according to the nature of the food; its quantity, the kind of digestion, &c.

What is meant by *Defecation?* It is the expulsion of the feces from the rectum.

What is *Thirst?* It is the desire for drink, and is an internal sensation resembling hunger, arising from the necessities of the system, caused by a constant drain of the fluid portions of the blood.

What are the exciting causes of thirst? Febrile and inflammatory diseases, loss of fluid from any cause, long speaking or singing, certain kinds of diet, and habit.

Where is the seat of the impression of thirst? Principally in the back part of the mouth and fauces; but whether primarily there, or produced by sympathy with the condition of the stomach, is not certain.

Can the sensation of thirst be allayed by injecting water into the stomach without its being applied to the fauces, or by injecting it into the blood-vessels? It can.

What change is produced in the blood by abstinence from liquids? It becomes more and more deprived of its watery portions.

Is the mechanism of deglutition of liquids the same as solids? It is.

What changes occur in liquids when swallowed? They acquire the temperature of the stomach, and become mixed with the secretions contained in it; some of them undergo chymification in whole or in part, and others do not; and of those that do not, some are absorbed directly from the stomach without change; and others are not, until they act upon the secretions of the stomach, by which they undergo some change, and then they are afterwards absorbed. Those liquids which are converted into chyle are either changed wholly into chyme, or else a part of it is separated which undergoes this process, and the aqueous or fluid portion remaining is then absorbed without change, either from the stomach, or else from the small intestine.

What is meant by *eructation?* It is the escape of gas from the stomach.

What is meant by *regurgitation?* It is when liquid or solid food, instead of air, ascends from the stomach into the mouth.

What is meant by *rumination?* It is the faculty of returning the food from the stomach into the mouth, to be again subjected to mastication and deglutition.

What is *Vomiting?* It is an inverted action of the stomach by which its contents are expelled, and is always preceded by both local and general disturbance. It differs from regurgitation in the sensation that precedes, the retching that accompanies, and the fatigue that generally succeeds it; regurgitation is not usually accompanied by indisposition, while vomiting always is to a greater or less extent.

In what order are the phenomena of vomiting exhibited? When it is caused by substances taken into the stomach, the first impression is made on its nerves, and transmitted from them to the nervous centres, from which it is reflected to the diaphragm and abdominal muscles in such a manner that they are thrown into contraction, and press upon the stomach; this organ also contracts from the pylorus towards the cardia; and by this combination of efforts the contents are ejected from the stomach into the œsophagus, and out of the mouth.

Absorption.

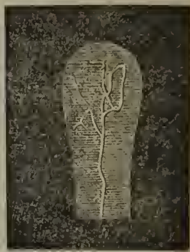
What are the different kinds of absorption? They are of two kinds—the *external* and *internal;* the former includes the absorption which takes place on extraneous matters from the surface of the body and the mucous membranes; and the latter, those that are effected internally on matters which form a part of the body itself.

What kind of absorption is effected in the organs of digestion? There are two kinds—one is where the matter absorbed is not subjected to digestive action, as liquids; and the other is where it has been subjected to a change, and fitted to be taken up by the appropriate vessels for that purpose.

Is there a peculiar apparatus for the absorption of chyle? There is; it is called the *Chyliferous Apparatus*, and consists of

the *chyliferous vessels* or *lacteals, mesenteric glands*, and *thoracic duct.*

Fig. 7.



The lacteals commence in the *villi* of the small intestines; each one in a villus, by a *closed extremity* (see Fig. 7); and the trunk issuing from each villus is formed by the confluence of smaller branches, which anastomose freely with each other, and form loops, so that there is no open orifice or free extremity opening upon the intestinal mucous surface. These vessels receive their contents by imbibition, which is a physical property of tissues.

How can chyle be obtained? By killing an animal while digestion is in full progress, after a full meal; it may then be procured by opening the thoracic duct.

What are the appearance and properties of chyle? It is a liquid, of a milky-white appearance; limpid and transparent in herbivorous animals, but opaque in carnivorous; it is not viscid or glutinous to the touch; the consistence is variable, according to the kind of food; neither acid nor alkaline, has a sweetish taste, spermatic smell, and specific gravity greater than distilled water. Its chemical character greatly resembles blood; the more nearly so, as it proceeds further along the vessels. It contains globules which have been supposed to be the nuclei or primordial cells from which all the tissues are formed. The constituents are water, fibrin, albumen, fatty matter, soda, chloride of sodium, and phosphate of lime.

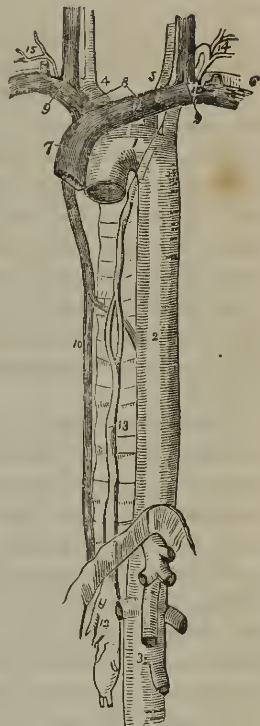
What is meant by *Chylosis?* It is the elaboration and absorption of chyle.

Does chyle exist in a separate state in the small intestine? It is first found in the chyiiferous vessels, and must be elaborated by them from the chymous mass formed in the intestine; this conversion or separation is a chemical process, but regulated by the laws of vitality in a peculiar manner. This function of chylosis has also been referred to the agency of cells, for the particulars of which see Carpenter's *Physiology.*

Does chyle always possess the same essential character? It

does; although it may vary slightly according to the food and digestive powers of the individual.

Fig. 8.



What is the course of the chyle? Along the chyliferous vessels and through the mesenteric glands into the receptaculum chyli,[12] or the beginning of the thoracic duct,[13] where it becomes mixed with the lymph, and is conducted into the subclavian vein.[14] The motion of the chyle along the vessels appears to proceed from a kind of peristaltic action in them.

What is the composition of the chyle in the lacteals prior to its entry into the mesenteric glands? Fat in large quantity; albumen in small quantity; and fibrin almost wanting.

What in the central lacteals, or those between the mesenteric glands and thoracic duct? Fat in medium quantity; albumen in large quantity; and fibrin in medium quantity.

What is its composition in the thoracic duct? Fat in very small quantity; albumen in medium quantity; and fibrin in maximum quantity. By this it will be seen that, in the process of assimilation, fat or oil globules diminish, while fibrin is proportionally increased.

As the chyliferous vessels are the exclusive agents of chylosis, and absorb nothing but chyle, by what means do fluids get into the circulation without assimilation? Through the medium of the veins.

By what agents is *Lymphosis* effected? A system of vessels closely resembling the lacteals, and having the thoracic duct in common with them.

How may lymph be procured? By opening a lymphatic vessel, and collecting it as it issues from it; and also by letting the animal fast several days, and then opening the thoracic duct. The

former method is uncertain, and the latter does not give it in a state of entire purity. Obtained from the thoracic duct in this way, it is of a rosy and slightly opaline tint, spermatic smell, and saline taste.

What is understood by *lymphosis?* It is the action of elaboration by which lymph is formed.

What disposition is made of the lymph? It is emptied, along with the chyle, into the venous system.

What is the apparatus of *Venous Absorption?* An extremely numerous set of vessels, called veins, which commence in the textures of the body by the capillary vessels, and terminate in the heart; they also receive the products of their own absorption, and of the lymphatics and the lacteals.

In venous absorption is there any vital elaboration, as in the absorption of chyle and lymph? The weight of evidence is against it; it is, therefore, supposed that venous absorption is effected by imbibition.

What are the different kinds of *Internal Absorption?* The *instertitial*, *recrementitial*, and *excrementitial*. By the first, the different textures of the body are decomposed, and conveyed into the mass of the blood. The second is the absorption of the various fluids effused into cavities. The third is the absorption from the excretions in their reservoirs or their excretory tubes.

What are the agents of these absorptions? The lymphatics or veins, or both. By the lymphatics, when the substance absorbed has been selected and elaborated; and by the veins, when no change or conversion has taken place in the material absorbed.

The sum of the matter appears to be this: the chyliferous and lymphatic vessels form and transmit only chyle and lymph, with some saline matters; while the veins take up and transmit every liquid that is sufficiently thin to permit imbibition through the coats of the veins.

What is meant by *Accidental Absorption?* It is the absorption of substances adventitiously introduced into the body, or placed in contact with some part of it.

Can absorption take place from the cutaneous surface? It can; but it does not take place readily while the cuticle is entire, unless soaked by immersion in a fluid for some time.

What are other instances of accidental absorption? Where

substances are retained in excretory ducts, or situated in parts not natural to them. For instance, when the bile is arrested in its excretory duct, there is soon evidence of its existence in the blood from absorption. Also, where blood is effused into the cellular membrane from any cause, it is found to disappear by absorption; the serous portions first, and the more solid portions afterwards.

Do all the different products of absorption mix? They do; from whatever source they may be derived, or however different they may be, and form one mass which is converted into arterial blood by the changes which take place in the lungs.

Of Respiration.

What is the great object of respiration? To convert the venous blood with its absorbed matters into arterial blood, by a function termed *hematosis*.

Where does this conversion take place? In the air-cells of the lungs, the air of which comes in contact with the blood, and gives to it some of its constituents, receiving other portions from the blood in return. The pulmonary apparatus and atmospheric air are, therefore, essentially concerned in this function, and it is necessary that the action and properties of each should be understood.

Are the muscles of respiration under the control of the will? They are partly under the control of the will, but not entirely; they are, therefore, termed *mixed*, neither belonging exclusively to the voluntary or the involuntary.

What is the cause of respiration? It proceeds from an internal sensation developed, probably, by the lung, through its ganglionic nerve, and carried to the brain or spinal marrow through the medium of the pneumogastric, which calls into action the muscles of inspiration, and has been called the "chief excitor" of the respiratory movements.

What movements constitute respiration? The dilatations and contractions of the thorax, or *inspiration* and *expiration*.

In what manner is *inspiration* effected? Gentle inspiration is produced almost entirely by the action of the diaphragm; but in deep and forced inspiration the respiratory muscles, which elevate the chest, are also called into action. In both cases, their action

is to enlarge the cavity of the thorax, and by that means air is caused to enter the lungs, producing inspiration.

What quantity of air enters the lungs at each inspiration? There is a great difference in different persons, and in the same person; depending upon whether the inspiration is gentle, deep, or forced.

The average estimate is about twenty cubic inches, which mix with the air already in the lungs after the previous expiration.

In what manner is *expiration* effected? By the elasticity of the cartilages composing the chest, and the yellow tissue of the bronchia, to a certain extent, when the diaphragm and other muscles are relaxed; but this is accomplished still further by the action of appropriate muscles, such as the triangularis sterni, the broad abdominal muscles, rectus abdominis, sacro-lumbalis, serratus posticus inferior, &c.

Can the lungs be entirely emptied by a forced expiration? They cannot.

Is the bulk of the air diminished by respiration? It is diminished about one-fiftieth of its bulk, as near as can be ascertained.

What is the quantity of air remaining in the lungs after a forced expiration? According to Bostock, there are one hundred and twenty cubic inches; two hundred and ninety when in a natural or quiescent state, and three hundred and thirty in a distended state; so that about one-eighth of the whole contents of the lungs is changed by each respiration, and that rather more than two-thirds can be expelled by a forcible expiration.

What is the relative time occupied by these different movements of respiration? The inspiration occupies about five-tenths of the whole time, the expiration about four-tenths, and the interval between the expiration and the succeeding inspiration one-tenth.

What is the number of respirations in a minute? About eighteen on an average; although it is subject to variation from this in different individuals, and at different periods of life, and from some other circumstances.

The ordinary numerical proportion between the respiratory movements and the pulsations of the heart is about one to four, and when this proportion is widely varied from, there is reason to suppose that either the nervous system, or organs of respiration, are disordered.

What other functions are concerned in the respiratory movements? The sense of smell; sucking; straining, or the employment of violent effort; the expulsion of the various excretions, voluntary and involuntary—such as defecation, spitting, coughing, sneezing, vomiting, accouchment, &c.; and the expressions—as sighing, yawning, laughing, crying, sobbing, &c.

By what function are the changes produced on the venous blood which render it fit for nutrition? The function of *sanguification* or *hematosis*.

What are the changes effected upon the air and blood by this function? The air loses a portion of oxygen and azote, and acquires carbonic acid: the bulk of it also is diminished; but different cases present different results in regard to the amount of these changes. The blood, in passing from the right side of the heart through the lungs to the left side, becomes of a florid color, and this is caused by contact in the lungs with oxygen, where carbonic acid is also given off; but not in so large a proportion as oxygen is absorbed. This change, in the constituents of the air and the blood, is effected by passing through the coats of the bloodvessels. Aqueous vapor, containing albumen, is also discharged from the lungs.

What are the sources from which the carbonic acid is derived? 1st. The continual decay of the tissues: the amount of which is influenced by a variety of circumstances. 2d. The metamorphosis peculiar to the active condition of muscular and nervous tissues. 3d. By the direct conversion of the carbon of the food; this last source seems to be peculiar to warm-blooded animals, and varies in quantity with the amount of heat to be generated.

What are the essential arrangements of all organs of respiration? The general plan is the same in all, and consists of membranous prolongations of the external surface, which is adapted by its vascularity and permeability to bring the blood and air, or a medium containing air, into close relation.

When the air is contained in water and respired, the organ consists of vascular tufts or fringes, called *gills;* but where the air is breathed as it exists in the atmosphere, the surface is reflected inwardly, forming chambers or passages, by which the air and blood are brought into the proper relation. By one or the other of these arrangements, we find that sufficient surface is provided

for effecting the respiratory changes, in accordance with the wants of the animal.

What are the relative proportions between the oxygen inhaled, and the carbonic acid exhaled? They are inversely as the square roots of their specific gravities; that is, the quantity of oxygen absorbed will exceed the carbonic acid given off in the proportion of 1174 to 1000. Carbonic acid contains precisely its own volume of oxygen; therefore, in 1174 parts of oxygen absorbed, 1000 are thrown off as carbonic acid, leaving 174 parts to be disposed of in some other way. A portion of this forms a union with sulphur and phosphorus in the body; the remainder of this most probably unites with the hydrogen of the fatty matter, and in this way forms a portion of the water exhaled from the lungs.

The quantity of carbonic acid exhaled varies greatly; the mean being about 160 grains of carbon per hour for an adult. The amount is varied by the development of the body, and by sex, being larger in the male, in which the quantity increases from eight years to thirty; stationary until forty; and decreases till old age, when it accords with that at ten very nearly. The quantity is in proportion to muscular development.

In females the increase agrees with that in the male until puberty; remains stationary during menstrual life, and then decreases, after the age of fifty, as in men. During pregnancy, it increases, and also when the menses are suspended from other causes. Cold, exercise, a full meal, and some of the exanthemata increase it. Diminished in chronic diseases of the respiratory organs, sleep, and typhus fever. It varies also in time of day; greatest at mid-day, and decreasing until midnight, and again increases. It is not formed in the lungs, these organs being merely the medium of its exit. Many ingenious theories have been advanced to account for the change of color, but it is not yet satisfactorily accounted for; we know, however, that it is connected with the action of oxygen on the red corpuscles.

Is there any change produced in the blood by coming in contact with the air on the cutaneous surface? It is believed by some that there is, but it is a matter not entirely settled.

What is the effect of dividing the pneumogastric nerves, or eighth pair of Willis? If both sides are divided, death is produced more or less promptly, the blood being less and less changed

from the venous to the arterial, as time elapses, until life ceases. If the nerve of one side only is divided, then one lung only is affected.

So that the pneumogastric nerve supports the function of the lungs by contributing to the change of blood from the venous to the arterial, besides its agency in the different parts of the digestive process.

What effect is produced by tying the phrenic nerve? Asthmatic breathing, performed by the intercostals; and death in a short time.

Where is the central nervous point of the respiratory movements? It is supposed to be the upper part of the medulla oblongata.

Of the Circulation.

What is the object of this function? The distribution of the blood to the various parts of the body, and its return to the great central organ — the heart.

What is the course of the blood in the circulation? It sets out from the heart, and is first distributed to the lungs, there to undergo the changes pointed out under the head of Respiration; it is then sent to the opposite side of the heart, from whence it is distributed to every part of the system by the arteries, and returned by the veins to the right side of the heart, from which it set out.

Is the heart a single or double organ? It is double, and each side of it is composed of two cavities: the one which receives the blood from the veins is called the auricle, and the one which propels it is the ventricle.

How are these two sides of the heart designated? One of them is appropriated to the venous blood, and is called the venous heart — also the right or anterior heart. The other circulates only arterial blood, and is called the arterial heart — also the left or posterior heart, from the relative position of the two sides. The first is sometimes also called the pulmonary heart, and the latter the aortic.

This arrangement also presents two circulations: one from the right side of the heart, through the lungs, to the left side, which is called the lesser or pulmonic circulation; and the other, from the left side along the arteries, through the whole system, and back by

the veins to the right side, and is called the greater or systemic circulation.

What are the organs of the circulation? The *heart*, *arteries*, *capillaries*, and *veins*.

What is the quantity of blood in the arteries and veins? It is difficult to form a correct estimate of the quantity of the circulating fluid, but the nearest approximation we have to it is, perhaps, that it consists of about one-fifth of the whole weight of the body, and that the proportion between the amonnt in the arteries and in the veins is as four to nine.

What are the constituents of the blood? Living blood, or blood circulating in the vessels, consists of liquor sanguinis and red corpuscles (Fig. 9); but when coagulated, it is separated into two portions; one is a yellowish fluid, called the serum; and the other is a red solid, called clot, cruor, crassamentum, coagulum, &c. The proportions of these vary, from several circumstances. The serum contains water, various salts, fatty matters, extractive matters, and albumen; and the crassamentum consists of fibrin, and the red corpuscles, called also cruorin, hematin, hematosin, &c. The coloring matter of the blood resides in distinct particles or globules, and, according to the best observers, in their envelope; but upon what chemical compound it depends is still very uncertain.

Fig. 9.

Upon what does the formation of a clot depend? The fibrin, which, by assuming the solid form, gives rise to the coagulation of the blood.

Is the coagulation of the blood a chemical or a vital process? It is a disputed point among physiologists. Some chemical agents retard or destroy, while others accelerate it.

When was the circulation of the blood discovered? In 1619 the celebrated Harvey obtained a full knowledge of the fact, but did not communicate it till the world until 1628.

What was Harvey's doctrine of the circulation? He taught that the venous blood is brought from every part of the body, and

emptied into the right auricle of the heart, from the right auricle it flows into the right ventricle, by which it is projected into the pulmonary artery, enters the lungs, and passes through the capillaries into the pulmonary veins. By these it is conveyed into the left auricle, and from thence to the corresponding ventricle, which contracts and sends it into the aorta, from which it is carried to every part of the body, through the ultimate ramifications of the arteries—the capillaries; these communicate with the veins, which collect the blood, and carry it to the right side of the heart. The evidences in proof of this are numerous.

In what manner is the circulation effected in the heart? The blood is received into the two auricles synchronously, which contract at the same moment on two sides, so that the two ventricles are filled, and by their synchronous contraction (which is continuous with that of the auricles), the blood is emptied into the corresponding arteries. Relaxation and dilatation in the case of both auricles and ventricles succeed immediately their contraction on both sides of the heart.

How do these actions of the heart take place in the order of time? Experiments have proved that the ventricles contract and the auricles dilate at the same time, and occupy about one-half of the whole time required for contraction, diastole, and repose. As soon as the systole of the ventricle terminates, its diastole succeeds and occupies about one fourth of the whole time; synchronously with which blood flows into it from the auricle. The other fourth, the heart is in a state of repose; but at the latter part the auricles contract with a short, quick jerk, which drives the blood into the ventricles, and then contraction is also transmitted to the ventricles in an almost continuous manner.

What is understood by diastole and systole of the ventricles? Their dilatation is called diastole, and their contraction systole.

Are there any sounds produced by the action of the heart? By applying the ear to the præcordial region, with or without the stethoscope, we hear at first a dull, lengthened sound, synchronous with the arterial pulse; this is called the first sound of the heart. Then succeeds a sharp, quick sound, like the flapping of a valve, which is the second sound of the heart

What are the causes of the *first sound* of the heart, and at what period does it occur? The first sound is believed to depend upon

the *rush of blood* through the comparatively narrow orifices of the aorta and pulmonary artery, the *passage of blood* over the rough internal surface of the heart, the *bruit musculaire* of the auricles and ventricles in contracting, upon the sound produced by *tension* of the *chordæ tendineæ*, and the *closure* of the auriculo-ventricular valves; so that it is not dependent upon a single cause, but from the combination. It occurs synchronously with the pulse (in the vessels near the heart), the impulse, and the systole of the ventricles. It is heard with the greatest intensity over the body of the ventricles.

What is the cause of the *second sound* of the heart? The second sound is referable exclusively to the *closure* of the semilunar or sigmoid valves, and is, therefore, heard with the greatest intensity over the aorta.

The following, from Carpenter, may assist the memory:—

First Sound.—Ventricular systole, and auricular diastole. Impulse against the chest. Pulse in arteries.

Second Sound.—First stage of ventricular diastole.

Interval.—Short repose; then auricular systole, and second stage of ventricular diastole.

Are the arteries concerned in the progression of the blood, or is it owing entirely to the action of the heart? The blood is moved in its course partly by the contraction of the arteries.

What is the nature of this *arterial contraction*? It is partly from the *elasticity* of the middle coat, and partly from an *active contraction*. In the large arteries the principal force exerted is from the elasticity, while the active contractile property increases as we recede from the heart. In addition to elasticity and contractility, arteries have also a power of *slow* contraction, which is properly termed *tonicity*, differing from both these, and is a vital property possessed by arteries.

What part or agency have the *capillaries* in the circulation? They possess a vital power of contraction, and they are also supposed to have a vital property of expansibility, or of becoming turgid. It is, therefore, inferred that the capillaries, by their contraction, contribute materially to the circulation, by propelling the blood forward into the veins.

What are the *forces* that propel the blood in its circulation? The action of the heart, the elasticity of the arteries, the contrac-

tile force of the smaller vessels, particularly of the capillaries, and the slight elasticity of the veins, and perhaps they also have a small share of contractility. The suction power of the heart in dilating (whether from its elasticity or an active dilatation, we will not decide) has an effect in bringing the blood to it; the suction power of the chest in inspiration also has an agency in causing the blood to flow to the heart by the veins; while, perhaps, expiration encourages the flow from it by the arteries.

What are the modifying forces of the circulation? *Friction*, *gravity*, *curvatures*, and *anastomoses*.

What effect has *friction*? It retards the progress of the blood along the vessels.

What effect has *gravity*? It may be either an increasing or a retarding force, according to circumstances. Position, therefore, has an effect upon the circulation, whether we take a portion of the body, or the whole. A knowledge of this fact is often of importance in a therapeutic point of view. If the body is in a horizontal position, the heart beats with less energy and frequency than when erect, and the amount of blood is increased in a part by depressing it below the centre of the circulation; because the circulation by the arteries is increased, while that by the veins is diminished: on the contrary, if a part is elevated, gravity retards the circulation by the arteries and facilitates that by the veins.

What effect have *curvatures*? They retard the progress of the blood in the circulation.

What is the cause of the *pulse*? Dr. Parry ascribes it to the impulse of distension given by the blood as it passes through any part of an artery, from the contraction of the left ventricle.

What is the frequency of the pulsations or pulse? In the healthy adult male, the average is from seventy to seventy-five per minute; but temperament, habit of life, position, &c., vary this very much. The pulse of the adult female is usually from ten to fourteen beats quicker than it is in the male, other circumstances being similar.

What are the uses of the circulation? Principally to transmit to the lungs the blood in a crude condition, so that it may be converted into arterial blood; and then to convey this arterial blood to the different organs of the body for the purposes to which it is applicable.

Of Nutrition.

What is understood by the function of nutrition? It comprises the changes which are constantly taking place in the body, both of absorption and deposition, and which effect the decomposition and recomposition, or renovation of each organ or portion of organized living bodies.

What is the *apparatus* by which it is effected? The deposition is supposed to be performed by a set of minute vessels, branches of the capillaries, whose function is to exhale nutritive substances; and are therefore termed *exhalents* or *nutritive exhalents.* The decomposition is carried on by the *absorbents.*

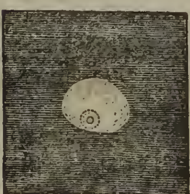
By what kind of absorption is decomposition produced? By what is termed *instertitial, organic,* or *decomposing absorption.*

What portion of the absorbent system is concerned in this absorption? The lymphatics are principally, if not entirely, concerned in the absorption of solids, which are broken down and reduced to lymph by a process with which we are unacquainted.

In what condition does the organic molecule in its simplest form exist? By some it is believed to consist of a cell, and by others of a fibre; perhaps it exists in both forms.

What is understood by the doctrine of cells? It supposes a matrix or organizing material, called cytoblastema or blastema, prepared for the formation of the tissue: in vegetables this is supposed to be a liquid gum or vegetable mucus; and in animals the liquor sanguinis, which consists essentially of fibrin. In this matrix or blastema minute granular points are exhibited, which increase in size from the agglomeration of the minuter granules around the larger, and constitute nuclei, or cytoblasts, or cell germs, which have within them, and formed before them, well-defined bodies, termed nucleoli. From these cytoblasts cells are formed, which are the primordial cells (see Fig. 10). A transparent vesicle is seen to project from the cytoblast or cell germ, as a watch glass does from the dial; this is the commencement of the cell, which extends and becomes so large that the cytoblast appears like a small speck within, and on its walls. This vesicle or cell is filled with a fluid, and is irregular in shape, depending

Fig. 10.



upon pressure, and the different forms in different tissues So that the order of this process is, therefore a matrix or organizing material, called *cytoblastema* by some, and *blastema* by others; which is a fluid in which first nucleoli are formed, then nuclei or cytoblasts, and then cells are developed.

Under what circumstances are these cells formed? They may originate in two modes: either in an organizable material under the influence and in contact with a living solid tissue, or in the interior of previously formed cells — therefore, multiplied and increased in both these ways According to this theory of cells, the process of nutrition consists in the growth of the individual cells composing the body; and that these derive their support from the organic componnds which are supplied to them by the blood; the different parts selecting, appropriating, and converting to their own structure such materials as are adapted to their growth.

What ground is there for believing that a fibre may also be a primitive organic molecule? The advocates of the doctrine that cells are the only simple organic molecule, believe that fibres are formed from cells being so arranged as to form the fibrous tissue; while the advocates for the fibre organic molecule contend that cells are not necessary to the formation of all tissues, since fine fibres are found in fibrin that has coagulated out of the body; and that there is an analogy of structure between false membrane and fibrin coagulated after death, or after it has been removed from the body. The appearance of fibrils also so quickly after coagulation could hardly, according to Gulliver, take place or be prodnced, if they had to be formed by the process of cells. These are, however, points upon which physiologists are not yet settled. According to Dr. Dunglison, all we can assert is, "that the vital property which exists in organizable matters—in the fibrinous portion of the blood, and in the blastema that is furnished by the parents at a fecundating union—gives occasion to the formation of cells in some cases, of fibres in others; and that the tissues are farther developed through the agency of this *cell-life* or *fibre-life*, so as to constitute all the textures of which the body is composed."

Does the action of nutrition affect the weight and size of the body? It does, through all the periods of existence. The cause of the development or growth of organs, and of the whole body,

and of the limits assigned to such development, is dependent upon vital laws which are beyond our power to fathom.

Is nutrition equally active in the different organs, or in the same organs under all circumstances? It is not; exercise increases its activity, in the muscles, for instance; and in the glands, muscles, and skin, it goes on much more rapidly than it does in the tendons, fibrous membranes, bones, &c.

The state of health, age, constitution, &c., also modify this process. *Hypertrophy* or *excessive nutrition* occurs when the material for nourishing the body is deposited more rapidly than required by the waste; this frequently occurs with particular organs, and but very seldom in the *whole* body. *Atrophy* is the reverse of hypertrophy, being a condition of diminished nutrition; this may also be confined to particular organs, but it is usually more general.

When parts are lost, the reparative nutritive operations are analogous to what takes place in the first development, and occur with great rapidity.

Inflammation is not necessary to this process.

The death of individual cells is termed *molecular* death; while the death of the whole body is termed *somatic* death.

Nutritive processes are not dependent upon nervous influence for their existence, but they are influenced by it; and it may be considered essential to their perfect condition.

These processes are *perverted* in a great variety of ways in disease, and may be produced by numerous causes, of which the *quality* of the material furnished is frequently one.

Is there any certainty as to the period of time it requires to effect a complete change in the constituents of the system? We have nothing certain on this point.

Of Calorification.

What is understood by this function? It is that function by which bodies preserve the temperature peculiar to them, independent of the surrounding temperature, within certain limits.

By what means do living bodies preserve their temperature when placed in one below what is natural to them? The three great functions of respiration, innervation, and circulation appear

to be necessary to this end; it is a function executed in the intermediate system, or system of nutrition of the whole body, by a special chemico-vital action. No single act of this function in its extended sense can account for it; but it is to the whole of them combined, commencing with digestion, that we are to look for a solution of this problem.

The amount of heat produced seems to bear a direct proportion to the amount of oxygen taken into the system, and the carbonic acid disengaged, and is, no doubt, connected with this conversion. This function is influenced by age, sex, temperament, idiosyncracy, &c.

The red corpuscles of the blood are important agents in this process.

How is the natural temperature of the body preserved in a high temperature? It is by the elimination of aqueous matter from the system, and its evaporation from the surface of the body.

Of Secretion

What is understood by secretion? It is a multiple function, which takes place in the tissue of our organs, and separates from the blood the various humors of the body. The term is applied both to the operation and the product.

Do the organs executing the various secretory operations differ from each other? They do very much; they have, however, been grouped into three classes — the *exhalant*, the *follicular*, and the *glandular*.

What is the *exhalant apparatus?* This function is attributed to a set of vessels termed exhalants, which are regarded by many as nothing more than the minute radicles of ordinary arteries.

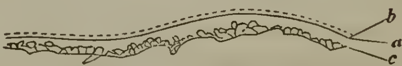
What is meant by the *follicular organs?* A *follicle* or *crypt* is an organ having the form of an ampulla or vesicle, situated in the substance of the skin and mucous membranes; and secretes a fluid for lubricating these parts, which is discharged either by a central aperture, or very short duct or lacuna.

What is a *glandular* organ? A gland consists of an artery, an intermediate body, called parenchyma, which is the proper structure of the gland; of an excretory duct for carrying off the secreted fluid; of veins, lymphatic vessels, and nerves, which proceed from

the ganglionic system; these are all bound together by cellular membrane. They are composed of lobules, each of which is composed of the above elements; these are held together with cellular substance, and have a membrane investing the whole.

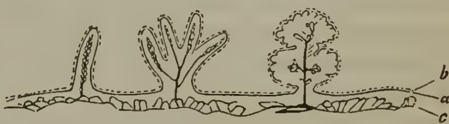
The simplest form of secretory apparatus is, therefore, a simple capillary vessel, and animal membrane; and the follicles and glands possess a more complex organization, but still essentially identical; every secreting organ possesses, as essential parts of its structure, a simple textureless membrane, called *primary* or *basement mem-*

Fig. 11.



brane (*a*), *cells* (*b*), and *bloodvessels* (*c*), (Figs. 11, 12, and 13, *A*). These three structural elements are arranged in various modes, and

Fig. 12.



have been classed by some under one one or other of two principal divisions — *membranes* and *glands*. In some the basement membrane is extended by eversion into processes (Fig. 12), but more generally this extension is produced by inversion and convolution, as in Fig. 13, *A*, *B*, *C*, *D*.

Simple glands are represented by Fig. 13, *A*, in three forms; straight tube (*g*), sac (*h*) coiled tube (*i*).

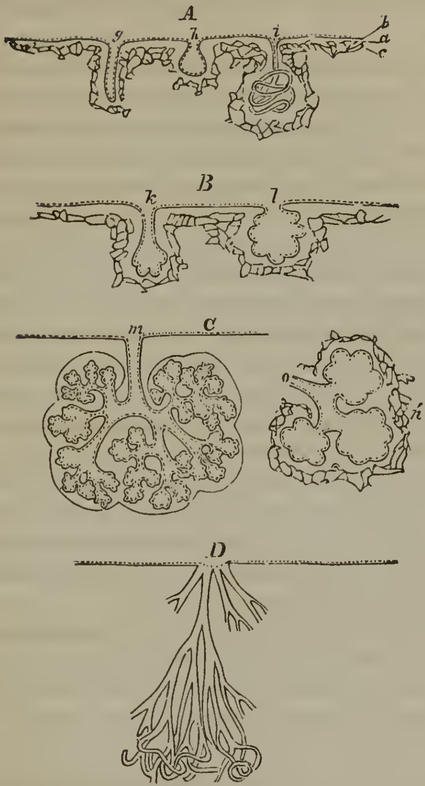
Multilocular crypts by Fig. 13, *B*; of tubular form (*k*) sacculated (*l*)

Racemose or *vesicular compound glands* by Fig. 13, *C*; entire gland showing branched duct and lobular structure (*m*); a lobule (*n*), with a branch of duct (*o*).

A *compound tubular gland* by Fig. 13, *D*.

Is the physiology of this function well understood? It is not.

Fig. 13.



All we can with certainty say is, that secretion takes place in the parenchyma, or in the capillary system of the secreting organ.

The mysterious agency presiding over this function has been a matter of controversy for a long time, and is not yet settled. It has been explained by exclusive mechanical, chemical, and vital theories. Perhaps the truth is, that it is a vital process modified by mechanical and chemical laws and agencies, and accomplished through the agency of cells.

How are the *secretions* divided? Into *exhaled secretions*, or *exhalations*, *follicular secretions*, and *glandular secretions*. Other

divisions have been adopted, but this one, founded on the nature of the secreting organ, has been adopted by Bichat, Magendie and Dunglison.

How are the *exhalations* divided? Into *internal* and *external.* The former are recrementitial, and the latter recremento-excrementitial. In the first class are the serous exhalations, the serous exhalation of the cellular membrane, the adipose exhalation of the cellular membrane, the exhalation of marrow, the synovial exhalation, the exhalation of the coloring matter of the skin, and of other parts, and the areolar exhalation. In the second are the exhalation of the skin, and the exhalation of mucous membranes.

What organs secrete the *serous* exhalations? The pleura, pericardium, peritoneum, arachnoid coat of the brain, and tunica vaginalis testis. In health this fluid lubricates these cavities, which appears to be its principal use, but does not accumulate, being taken up by the absorbents; a change in the relation between exhalation and absorption may give rise to dropsy. This fluid is supposed to transude through the parietes of the arteries, and to be taken up by imbibition through the coats of the veins. The serous exhalation of the cellular membrane is analogous to this, and appears to have the same uses, that of lubrication, and facilitating the motion of the parts.

What is the organ upon which the *adipose* exhalation depends? The *adipose membrane*, which forms a vesicle in which the fat is included; and it is attached to the cellular tissue.

What are the organic elements of fat? *Olein*, *stearin*, *margarin*, and *glycerin.*

What are the uses of fat? They are both general and local. The first serves as a provision in time of need, whether from indisposition or abstinence from food. The second are of a physical nature, diminishing the effects of pressure, forming a cushion, and by filling up the interstices so as to give a rounded form and contour to the body.

Upon what organ does the exhalation of *marrow* depend? The delicate membrane which exists in the interior of bones, called the medullary membrane, and sometimes called internal periosteum. It perhaps serves the general purposes of fat, and also to fill up spaces that might otherwise be vacant.

What organ secretes the *synovial* exhalation? The synovial

membrane, which is situated within the articular capsules and the bursæ mucosæ.

What organs exhale the *coloring matter* of the skin? They consist of a glandular parenchyma, or organ of secretion, in the substance of the true skin, a little below the papillæ, with excretory ducts, which deposit the matter between them.

What is understood by the *areolar* exhalations? Those that are effected in parenchymatous structures — as the humors of the eye, &c.

What is the *cutaneous* transpiration or exhalation termed when invisible? The insensible transpiration or perspiration: and when it is perceptible, it is called sweat. It is secreted by a glandular parenchyma, situated in the skin, which secretes the fluid, with ducts opening on the surface of the body for its discharge. The quantity of this fluid is varied by a great variety of circumstances.

What is understood by the *pulmonary* transpiration? It is a secretion thrown off from the surface of the air-passages and lungs, resembling very much that thrown off by the skin, and is nearly identical with it in chemical composition.

How are the *Follicular* secretions divided? Into the mucous and the cutaneous.

What is the product of the secretion of the mucous follicles or crypts called? *Mucus.*

What are examples of the follicular secretion of the skin? The secretion on the face, which has the appearance of worms when forced through the external aperture of the follicle; the humor of Meibomius, and of the caruncula lachrymalis.

What are the *glandular* secretions? They are the milk, sperm, urine, bile, pancreatic juice, saliva, and tears.

What secretes the *tears*? The lachrymal gland; but, as we generally meet with them, they are mixed with the secretions of the conjunctiva, caruncula lachrymalis, and follicles of Meibomius.

What is the apparatus for the secretion of the *saliva*? A parotid gland, a submaxillary, and a sublingual, on each side.

What secretes the *pancreatic juice*? The pancreas, which resembles very much the salivary glands.

What is the apparatus for the secretion of *bile*? The liver, hepatic duct, gall-bladder, cystic duct, and the ductus communis choledochus.

What peculiarity is there in the structure of the liver? It is supplied with two kinds of blood — the arterial and the venous. From which of these the bile is secreted is yet unsettled.

What are the substances found in bile? *Cholesterine, bilic acid, biliverdin,* and some earthy salts.

What uses does the bile subserve in the animal economy? A portion passes off with the excrementitial part of the contents of the alimentary canal; another portion renders fatty matters soluble, and capable of being absorbed by the lacteals, and probably converts sugar into fatty matter. It contrains hydro-carbon in large quantity, the separation of which from the blood is of importance to the condition of that fluid.

What is the apparatus for the secretion of *urine?* The kidneys, ureters, bladder, and urethra.

What is the object of this function? It appears to be to depurate the blood, by separating from it the elements of the substances of which the urine is composed.

It is purely excrementitial, and it is the nitrogenous compounds that are eliminated.

What is the analysis of healthy urine, according to Berzelius? In 1000 parts it consists of: water, 933·00; urea, 30·10; sulphate of potassa, 3·71; sulphate of soda, 3·16; phosphate of soda, 2·94; chloride of sodium, 4·45; phosphate of ammonia, 1·65; muriate of ammonia, 1·50; free lactic acid, lactate of ammonia, animal matter soluble in alcohol, and urea not separable from the above, 17·14; earthy phosphates, with a trace of fluate of lime, 1·00; lithic acid, 1·00; mucus of the bladder, 0·32; silex, 0·03.

What are the organs termed *glandiform ganglions?* They are the spleen, thyroid, thymus, and supra-renal capsules. The uses of these are not well settled.

Of the Reproductive Functions.

What is the object of these functions? The preservation of the species; and the different functions tending to this result are treated of under the following head: —

Generation.

To what class of bodies is this function peculiar? To organized bodies exclusively.

What is understood by *univocal* generation? It is where generation is effected by a process requiring the pre-existence of an organized being; and equivocal generation is where generation is supposed to take place spontaneously, by extraneous influences, without requiring a parent. This last theory is not generally admitted, although advocated by many.

What is the simplest form of generation? It is where an animal, at a certain period of its existence, separates into several fragments, each of which forms a new individual. This is called *fissiparous* generation, or generation by spontaneous division.

What is meant by *gemmiparous* generation? It consists in the formation of buds, sporules, or germs, on some part of the body; these become developed, drop off, and form as many new individuals. In both these forms generation is executed by a single individual. Higher in the scale we have separate organs, which are divided into the male and female; some organized bodies have both in the same individual; but as we ascend in the scale to the superior animals, they are separated, and belong to distinct individuals, in which case copulation becomes necessary.

What are the varieties of this kind of generation where copulation is necessary? In the first place, the ovum may be fecundated, laid by the female, and hatched out of the body, which is called *oviparous* generation.

Secondly. The process of laying may commence, and the fecundated ovum pass so slowly, that it is hatched before it is expelled. This is called *ovo-viviparous* generation.

Thirdly. The fecundated ovum may be detached from the ovary soon after copulation, and then deposited in a womb or uterus, there to be developed until the proper period for its expulsion, after which it may be further nourished by a peculiar and appropriate secretion furnished by the mother. This is *viviparous* generation.

Lastly. There are animals provided with pouches, into which the young, born at an early stage of their growth are received and nourished with a secretion furnished by the mother from glands

situated in these pouches. These are the *marsupial*, and the opossum may be considered as the type.

The young are also sometimes born with the shape peculiar to them, and at others with forms which are changed materially, as in the papilio, or butterfly.

What are the different acts necessary for reproduction in the human species?

Generation, or the formation of germs.

Copulation, or the union of the sexes.

Fecundation, or the vivification of germs.

Conception, or the retention of the vivified germs.

Gestation, or *pregnancy*.

Parturition, *delivery*, or *accouchment*.

Lactation, or the nourishment of the infant with milk.

What are the male organs of generation? The two *testes;* the *excretory ducts* of these glands, called *vasa deferentia;* the *vesiculæ seminales;* two canals, called *ejaculatory;* and the *penis*.

What secretes the *sperm*, or fecundating fluid of the male? The testicles; when formed, it is received into the tubuli seminiferi, and passes along them to the epididymus, the vas deferens, and the vesiculæ seminales, where it is deposited, until it is discharged into the urethra during venereal excitement.

What are the female organs? They are those inservient to copulation and fecundation, and those for gestation and lactation.

What is understood by *Menstruation?* It is the periodical discharge of a bloody fluid from the vulva, occurring once in about twenty-eight days, and lasting from three to six days. This discharge is called the *catamenia*, *menses*, *flowers*, &c., and continues during the whole time the female is capable of conceiving, from puberty to the critical age, or time of its cessation This process is accompanied by the maturation and discharge of an ovule from the ovary, which occurs once every twenty-eight days in health, and is the essential action of the sexual function.

What organ gives out this fluid? It is an exhalation or secretion effected from the internal surface of the uterus.

Is menstruation necessary to *impregnation?* As a general rule its appearance denotes the capability of being impregnated, and its absence the want of capability; yet there are exceptions to it.

Where does *fecundation* and *conception* occur? In the ovarium.

What period elapses after fecundation before the ovum arrives in the uterus? About ten or twelve days.

How may the hypothesis of generation be divided? They may be classed under two heads—the system of *epigenesis*, and that of *evolution*.

What is understood by the system of *Epigenesis?* It is the theory which supposes the new being to be formed of materials furnished by both sexes, the particles of which previously possesed the necessary arrangement for constituting it; and it is also supposed that these particles have a controlling agent or force which regulates their affinity, different from the ordinary forces of matter, and this force has been termed *cosmic*, *plastic*, *nisus formativus*, &c. &c.

What is understood by the theory of *Evolution?* This theory supposes that the new individual pre-exists in some shape in one of the sexes, but requires to be vivified by the other, in the generative act, after which commence the developments or evolutions which result in the formation of a distinct being.

How are the advocates of this theory divided? Some of them suppose that the germ exists in the ovary of the female, and requires only the vivifying influence of the male sperm to cause its evolution. These are called *ovarists.* Others suppose the male sperm to contain the rudiments of the new being, and that the female merely affords it a nidus and pabulum during its development. The latter are called *spermatists*, *seminists*, and *animalculists.*

What is understood by the doctrine of *omne vivum ex ovo*, as advocated by Harvey? It supposes all animals to orginate from an ovum, or egg, and that this is furnished by the female. In the human being, they are vesicules, ovules or ova, which exist in the ovaria, one of which matures, and is thrown off every twenty-eight days, wanting only to be fecundated by the male to be evolved and produce a living being.

What is the most modern view of this subject, as adopted by physiologists? It is a modification of the theory of epigenesis. They believe there must be a union of materials furnished by both sexes, otherwise it is impossible to explain the similarity of conformation to both parents; that the secretion of the male, the sperm cell, is united to the ovule furnished by the ovarium of the female; and that the embryo results from a union of these products, im-

pressed with life from the instant of such union, and with a greater or less resemblance to one or the other parent.

In what manner does the fecundating fluid of the male reach the ovaries? This is still a disputed question amongst physiologists; some alleging that it passes from the vagina into the uterus, thence along the Fallopian tubes to the ovaries; others suppose it to be transmitted from the vagina to the ovaries, through the intervention of special absorbents, but these have not as yet been proved to exist. The former theory seems the more probable, and that it is promoted by ciliary action.

Is there any consciousness of fecundation on the part of the female at the moment of its occurrence. There are no symptoms that can be depended on. At what period, in the human female, is conception most likely to occur? Immediately before and after the menstrual period; particularly the latter.

What is the proportion of twin cases in this country? About one in seventy-five.

Ages.

How are the different ages divided? Into infancy, comprising the period from birth until the second dentition; childhood, that between the second dentition and puberty; adolescence, that between puberty and manhood; virility, that between youth and old age; and old age.

How is the period of *infancy* divided? Into that after the child is ushered into the world until the first dentition, comprising about seven months. Secondly. The period of first dentition, and is considered to include the period between seven months and two years. Thirdly. The balance of the period of infancy.

Through what period does *childhood* extend? From the seventh to the fifteenth year, or to the period of puberty.

Through what period does *adolescence* extend? From about the fifteenth to the twenty-fifth year in men, and from fifteen to twenty-one in women.

How is the period of *virility* or *manhood* divided? Into three periods—crescent, confirmed, and decrescent virility. The first of these extends from the age of twenty-five to thirty-five in the male, and from twenty-one to thirty in the female; the second, from thirty-

five to forty-five in the male, and from thirty to forty in the female; the third, from forty-five to sixty in the male, and from forty to fifty in the female.

What is understood by *old age?* It is the period when everything retrogrades, and comprises three periods or stages: incipient, or green old age, extending to seventy years; confirmed old age, or caducity, to eighty-five years; and decrepitude, from eighty-five upwards.

Individual Differences among Mankind.

How are the differences designated? By the terms *temperament, constitutions, idiosyncrasies, acquired differences, and the varieties of the human species, or the different races of mankind.*

Temperaments.

What is understood by *temperaments?* They are those individual differences which consist in such disproportion of parts, as regards volume and activity, as to sensibly modify the whole organism, but without interfering with the health; and, therefore, being a physiological condition.

How are the temperaments divided? Into the *sanguine*, the *bilious* or *choleric*, the *melancholic*, the *phlegmatic*, and the *nervous.*

What are the characteristics of the *sanguine temperament?* There is a predominance of the circulatory system, characterized by a strong, frequent, and regular pulse; ruddy complexion; animated countenance; a good and distinctly-marked shape; firm flesh; light hair; fair skin; blue eyes; great nervous susceptibility; quick conception; ready memory; lively imagination; addiction to the pleasures of the table; and amorousness. The diseases of this temperament are generally violent; and are seated in the circulatory system — as fevers, inflammations, and hemorrhages.

What are the characteristics of the *bilious* or *choleric temperament?* The pulse is strong, hard, and frequent; the subcutaneous veins are prominent; the skin is of a brown color, inclining to yellow; hair dark; body moderately fleshy; muscles firm and well-marked; the passions violent and easily excited; temper abrupt and impetuous; great firmness and inflexibility of character; bold-

ness in the conception of projects, and untiring perseverance in their fulfilment. The diseases are generally combined with more or less derangement of the hepatic system, which is considered to be prominently developed.

What are the characteristics of the *melancholic temperament?* The vital functions are feebly or irregularly performed; the skin assumes a deeper hue; the countenance is sallow and sad; the bowels are torpid, and all the excretions are tardy; the pulse is hard and habitually contracted; the imagination is gloomy, and the temper suspicious.

What are the characteristics of the *phlegmatic, lymphatic,* or *pituitous temperament?* They are soft flesh; pale skin; fair hair; weak, slow, and soft pulse; figure rounded, but inexpressive; the vital actions more or less languid; the memory not tenacious, and the attention vacillating; with aversion to both mental and corporeal exertion.

What are the characteristics of the *nervous temperament?* The nervous system is predominant. The muscles are small, soft, and, as it were, wasted; a slender form, generally; great vividness of sensation; and promptitude and fickleness of resolution. The diseases incident to a predominance of this temperament are of the hysterical and convulsive kind; or those usually denominated *nervous.*

These distinctions are not always well marked, and the different temperaments are usually blended together, so as frequently to render it difficult to decide which one predominates.

Constitution and Idiosyncracy, &c.

What is understood by the *constitution* of an individual? It is the mode of organization proper to that person; and they are as numerous as the individuals themselves.

What is understood by *idiosyncracy?* It is a term applied to the peculiar disposition which causes an individual to be affected by extraneous bodies in a way different from that which they affect mankind in general.

PART III.

CHEMISTRY.

PART III.—CHEMISTRY.

WHAT is Chemistry? It is the science which makes known the composition of bodies, and the manner in which they comport with each other.

CALORIC.

What is understood by the term *caloric?* It is the cause or agent producing the sensation and phenomena of *heat.*

What are some of the properties of caloric, or heat? It has been supposed to be a subtle fluid, the particles of which repel each other, and are attracted by all other substances; it is imponderable; expands, and is present in all bodies; transferable from one body to another; tending to an equilibrium in three ways—by direct contact, by conduction, and by radiation. The generally received opinion now is, that the phenomena of heat are caused by vibrations of a very subtle etherial medium.

What are the principal conditions which influence the communication of heat by *direct contact?* The degree of contiguity, and the conducting power of substances; electricity is excited as caloric passes from one body to another.

How are bodies divided in regard to their power of *conducting* caloric? Into conductors, and non-conductors; among the former are the metals, and among the latter, or those which conduct very imperfectly, are glass, wood, charcoal, fluids, gases, and porous substances generally. With regard to the relative conducting power of the metals, they stand in the following order: Gold, the best; then, silver, copper, iron, zinc, tin, lead, and platinum.

Are liquids good conductors? Liquids have scarcely any conducting power; but when heat is applied to the lower portion of

them, ascending and descending currents are established; the heated particles, being expanded, rise, and colder ones descend to take their place; so that very soon every particle of the fluid is heated by direct contact with the heated portion of the containing vessel. If the heat is applied at the top, the liquid is scarcely heated at all, except at the surface.

What is understood by the *radiation* of caloric? When heat passes from one body to another, independent of a medium, therefore in vacuo, it is termed radiation; and the heat so distributed is called *radiant* or *radiated heat.*

A heated body suspended in the air has its temperature reduced to an equilibrium: what are the modes by which it is accomplished? It is done in three ways: first, by the *conducting* power of the air, which is very trifling; secondly, by the *mobility* of the air in contact with it; and, thirdly, by *radiation.*

How is heat distributed in radiation? It is emitted from the surface of a hot body equally in all directions, in right lines, like radii from the centre to the circumference of a sphere; and when they fall upon another body are distributed in three ways: *reflected, absorbed,* or *transmitted.* In the first and third cases, the temperature of the body on which the rays fall is not affected, in the other it is increased.

In what proportion does heat decrease as we recede from a body? It diminishes in the ratio of the squares of the distances from the radiating body.

Is the radiating power of a body influenced by the nature of the radiating surface? It is; a polished plate of metal radiates very imperfectly; if roughened, its radiating power is increased; and, if covered with a thin layer of paper, isinglass, wax, or resin, it is greatly increased.

The color of surfaces has been thought to have a great effect on the radiating power; black radiating the most rapidly, red less, and white still less. This has been the most prevalent view of the subject, although some recent experiments of Prof. Bache appear to prove that color alone, independent of the molecular structure, does not influence the radiating power of surfaces.

Can heat be reflected when accompanied with light? It can, and is subject to the same laws in this respect as light.

Will a good radiating surface make a good reflector? No;

neither will a good reflector make a good radiator, these properties being inversely to each other as a general rule.

When heat strikes an opaque body, and it is not reflected, what becomes of it? It is invariably *absorbed;* and these rays are supplemental to the rays which may be reflected if any are reflected.

What relation exists between the *absorptive* and the *reflective* powers of bodies? They are in an inverse proportion to each other. So that the more rays of heat that are absorbed by a body the fewer are reflected, and *vice versâ.*

What relation exists between the *radiant* and *absorptive* power of bodies? Those surfaces of bodies which have the absorptive power have the radiating power directly proportional in most instances.

So that one class of surfaces are good absorbers and radiators, while another are good reflectors and retainers; these qualities being in various proportions in different surfaces.

What is meant by *transmission* of heat? It is its passage unchanged, or nearly so, through transparent media, or through a vacuum.

Is heat subject to *polarization* and *double refraction?* It is; and also to *depolarization.*

By what means do bodies attain and keep up an *equality* of temperature? According to the theory of Prevost, all bodies are constantly radiating heat, or calorific rays, and the temperature of a body falls when it radiates more than it absorbs; on the contrary, the cooler body becomes warmer when it absorbs more than it radiates; and the temperature is stationary when the quantities emitted and received are equal.

An instance of the first case is exhibited when a hot body is surrounded by colder ones; of the second, when a colder one is surrounded by warmer; and of the last, when the temperature of the bodies near each other is equal.

According to another theory, bodies of equal temperature do not radiate at all, and when the temperature is unequal, the hotter bodies alone radiate.

What are some of the effects of heat on matter? It is essentia. to vital actions, both animal and vegetable. It influences the form of bodies, as regards their condition of *solidity, fluidity,* or

vapor. It also powerfully influences chemical action and combination.

Does heat invariably *expand* all bodies? It does, with the exception of some fluids, which are expanded also at high temperatures, and are contracted as the temperature falls, until at a certain temperature they again expand, forming an exception to the general law.

Upon what principle is a *thermometer* founded? The expansibility of fluids, and mercury is the one generally used.

Upon what principle is the *pyrometer* of Wedgewood formed? If we heat a mixture of aluminous earth and water or clay, it contracts from the expulsion of the water, and this contraction is an indication of the amount of heat to which it has been subjected. The temperature indicated by this instrument, however, is not reliable.

What is understood by *specific heat?* It is the quantity of heat which one body contains compared with other bodies of the same weight or bulk, and at the same temperature, as indicated by a thermometer. Thus, if A takes four times as long to heat to the same temperature as B does, then its specific heat is four compared to B's, which is one; so that differences in time of bodies in heating or cooling, similarly exposed, express their specific heat.

If we take a pint of mercury at 100°, and a pint of water at 40°, and mix them, the resulting temperature is only 60°, and not the mean between them; the mercury has lost 40°, and the water has gained 20°.

If equal weights are taken, it is still more evident:—

$$\left.\begin{array}{ll}\text{1 pound of mercury at} & 162^\circ \\ \text{1 pound of water at} & 100^\circ\end{array}\right\}\text{ gives a mixture at }102^\circ.$$

The water has gained only 2° while the mercury has lost 60°. Water has, therefore, a specific caloric compared with mercury of 30, while mercury is 1, or in the proportion of 30 to 1. This difference in bodies is sometimes termed *capacity for heat.*

What is understood by *sensible* and *insensible heat?* Sensible heat is that heat of which we can take cognizance by our senses; and insensible or *latent* heat is that which is proved to exist in a body, but does not affect our sensations, or our means of measuring temperature.

Latent or insensible heat may be illustrated by a simple experi-

ment: Mix a pound of water at 174°, with a pound of water at 32°; the resulting temperature will be the mean of the two, or 103°; if, instead of the water at 32°, a pound of snow or ice of the same temperature be substituted, the resulting temperature will be only 32° after the melting of the ice. Hence, as much heat will have been rendered latent *in the melting of the ice* as would have raised an equal weight of water *one hundred and forty-two degrees.*

It is found also that one pound of steam will raise ten pounds of water 100°, or if concentrated in one pound, the rise of temperature would be 1000°, or to about a red heat, if prevented from assuming the aëriform state. This heat imparted to the water exists in it in a latent state, or at least all above what can be accounted for by a temperature of 212°, which is the sensible temperature both of boiling water and steam.

Has every substance a specific heat peculiar to itself? It has; and a change of composition will produce a change of capacity for heat.

When has a substance the greatest capacity for heat, in a solid, or liquid state? In a liquid condition.

Does the specific heat of a gas vary with the density and elasticity? It does. A diminution of density increases the capacity, and *vice versâ.*

Is the specific heat of solids and liquids the same at all temperatures, when there is no change of composition? As the temperature increases, the capacity increases, but it is owing to their dilatation, as in the case of gases.

Does a change in specific heat produce a change in temperature? Always; an increase of capacity, therefore, of the specific heat diminishes the temperature; and a decrease of capacity is attended with an increase of temperature.

What determines the condition of bodies as to their condition of solidity, liquidity, or gaseous state? The relative intensity of *cohesion* and *repulsion.*

To what is the property of *repulsion* owing? To heat; and the form of bodies may be made to vary as this is increased or diminished. Every solid may be converted into a fluid, and every fluid into a vapor, provided our means for the production of heat are sufficiently powerful.

Is heat absorbed and rendered insensible, or cold produced, when solid bodies assume the *liquid* form? It is. This heat is sometimes called the *heat of fluidity*, and seems necessary to the change.

On this principle the cold produced by *frigorific mixtures* is explained. When snow and salt are mixed, a temperature of zero is produced, and arises from the attraction between the salt and water, producing liquefaction, and thereby heat is rendered latent, and cold is the result.

Is heat evolved, or made sensible during the passage of a liquid into a *solid?* It is; and a familiar instance exists in the formation of ice, which never gets below 32° while changing from a liquid to a solid state, let the surrounding temperature be what it may. And also in the *slaking of lime* by water; which produces an elevation of temperature from the water passing into a solid state.

Is there any essential distinction between *vapors* and *gases?* No: what are commonly called gases are merely vapors that are difficult to condense: some never have been condensed at all, but no doubt could be by sufficient pressure and reduction of temperature.

Gases are more expansible than either liquids or solids, and the rate of expansion is uniform, and the same in all gases, being about the 480th of their whole volume for every degree of Fahrenheit.

What is meant by a *fixed body?* It is a body which resists the strongest heat we are capable of producing without vaporizing.

What is meant by a *volatile body?* It is a body which is converted into vapor by our means of producing heat.

What is *ebullition?* It is where vapor is formed below the surface, giving rise to a commotion in the liquid; and the temperature at which this takes place is called the *boiling point.*

What is meant by *evaporation?* It is where vapor is formed below the surface and occurs at common temperatures.

Is the boiling point of all liquids the same at the common pressure of the atmosphere? No; sulphuric ether boils at 96° F., alcohol at 176°, and pure water at 212°, oil of turpentine at 316°, and mercury at 662°.

What circumstances modify the boiling point of liquids? Variation in the pressure of the atmosphere is the principal one. The material of which the vessel containing the liquid is composed has

an influence; also the presence of angular bodies. Liquids boil in vacuo at 140° lower than in the open air, and if subjected to sufficient pressure, may be heated to any extent without boiling.

The difference in the boiling point of water from difference in atmospheric pressure furnishes one of the best modes of ascertaining the height of mountains; a depression of one degree being equal to 548 feet of elevation, from the amount of pressure of the atmosphere being diminished in that proportion as we ascend.

A cubic inch of water, in becoming steam at the ordinary pressure of the atmosphere, expands nearly to a cubic foot in bulk; and a large amount of heat is rendered latent in the process.

What circumstances influence the process of evaporation? Extent of surface, and the state of the air, as to temperature, dryness, stillness, and density.

A diminution of temperature always results when evaporation takes place, and ice may under certain circumstances be produced by this means.

What are the *sources* of heat? The sun, combustion, electricity, the bodies of animals during life, chemical and mechanical action.

Light.

What is meant by the science of *Optics?* It is that science which treats of *light* and *vision.*

What is the nature of light? According to Newton, it is an emanation of inconceivably minute particles from luminous bodies; very subtle, and travels in straight lines with immense velocity, being 195,000 miles in a second. According to the other theory, it is simply vibrations, or undulations, of a subtle ethereal medium, which give rise to vision in a manner similar to what the undulations of the air impress the nerves of hearing.

What is meant by a *ray* of light? It is the smallest portion which can be separated from contiguous portions.

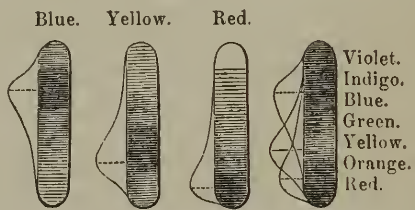
In what proportion does light decrease as we proceed from a luminous object? As the square of the distance from the luminous object increases.

When light falls on a body, in what manner is it disposed of? It is either *reflected*, *refracted*, or *absorbed*

Is solar light *simple* or *compound?* It is a compound of seven

simple or primary colors, viz: red, orange, yellow, green, blue, indigo, and violet. This has for a long time been the received opinion, but at present the views of Brewster prevail generally, which is, that, there are but three primary colors, red, yellow, and blue; and that the orange, green, indigo, and violet are compound ones: each color extends over the whole spectrum, but has its greatest intensity at one part (indicated by the height of the curve

Fig. 1.



in the diagram). There are also rays of the spectrum termed *calorific*, and *chemical*, and to which some have added the *magnetizing*.

The greatest *illuminating* power of the spectrum is about its middle, or between the yellow and green; the greatest *calorific* power is the red space, or beyond it, varying with the prism used; the greatest *chemical* power is in the most *refrangible* part of the spectrum.

Light is necessary to vegetable and animal existence, and many of the phenomena of the natural world are due to its influence.

What is understood by *terrestrial* light? It is artificial light; and the common method of obtaining it is by combustion.

What are instruments called that are designed for measuring intensities of light? *Photometers.*

Electricity.

What is understood by electricity? It is a principle called into action by rubbing substances called *electrics*, such as amber, glass, &c., with dry silk or cloth, and which causes contiguous light bodies to move towards them or be attracted; and the substance possessing this property of attraction is said to be electrified.

What is this attraction called? Electric attraction.

What takes place when these light substances come in contact with an electrified body? They recede or are repelled, and this property is called electric repulsion.

Can this property or electricity be conducted from one body to another? It can by some substances, but not by others; hence bodies are divided into conductors and non-conductors.

What are the *conductors?* Metals, charcoal, plumbago, water, and substances which contain water in its liquid state.

Are electrics conductors? No; they may be handled without losing their electricity, except at the parts touched; on the other hand, conductors are non-electrics, because the electricity is at once carried off.

Can a conductor be electrified or excited? It can, by being insulated or cut off from contact with the earth, either directly or indirectly, by means of a non-conductor.

TABLE OF CONDUCTORS AND INSULATORS.

Conductors.	Insulators.
Metals,	Spermaceti,
Charcoal,	Glass,
Fused salts,	Sulphur,
Strong acids,	Fixed oils,
Alkaline solutions,	Spirits of turpentine,
Water,	Resins,
Alcohol,	Ice,
Damp air,	Diamond,
Vegetable and animal bodies.	Shellac,
	Dry gases.

Why do electric experiments usually fail in damp weather? Because the atmosphere then acts as a conductor, and conducts the electricity off.

What are the different *conditions* of electricity? There is one called *vitreous*, because developed on glass, and another called *resinous*, because developed on resinous substances. They are also termed *positive* and *negative*, the terms vitreous and positive being used synonymously, as are resinous and negative.

What relation do substances bear to each other, *similarly* electrified? They *repel* each other.

When *dissimilarly* electrified? They *attract* each other.

How is electricity *excited*? By friction, change of temperature, chemical action, contact, changes of form of a body by variations of temperature, and proximity to an electrified body, or by induction; when excited by chemical means, it is called galvanism.

By *friction* is the most usual mode of obtaining electricity, and the ordinary electric machine is formed on this principle.

That *change of temperature* is a source of electricity, may be proved by heating metallic rods to different temperatures at their extremities; this is *thermo-electricity.*

Proximity to an electrified body, or *induction*, is another mode of exciting it that is often resorted to. Electricity may be forced through space at appreciable distances, even should a non-conducting substance be interposed; it arises from the attractive and repulsive powers ascribed to electric fluids. If an insulated conductor be placed with its end towards a prime conductor, the end towards the conductor will assume a negative condition, while its other end will be positive, and any series of conductors will assume the same condition, but with constantly decreasing intensity. It is an important principle in electricity.

Electrified bodies attract light objects to them, because an opposite state of electricity is induced. When we move the hand towards the prime conductor of an excited machine, a spark is given out on account of the hand being made negative by induction, and the spark restores the equilibrium. A cloud charged with electricity passing near the earth induces an opposite state, and lightning is the result, which is an electric spark on a large scale.

On what principle is the *Leyden jar* formed? That of induction. They consist of jars with wide mouths, coated internally and externally with tin foil. The mouth is closed by cork, through which a metallic conductor is conveyed to the inside coating, which is brought in contact with the prime conductor of an electric machine; it becomes charged positively, while the outside will be negative by induction. If a communication be established by a conductor between the two coats, a spark is produced, and the equilibrium established. The coating merely serves as a conductor to spread the electricity over the surface of the glass. A series of two or more of these jars may be arranged so as to constitute a *battery*, by connecting their internal surfaces together, and also

their external surfaces with each other. In this way the effects may be increased by discharging them all at once, imitating the lightning, which is the same thing on a large scale. The object of lightning rods is to establish or preserve the equilibrium between the cloud and the earth; they are *pointed*, so that this may be done silently; if they presented a blunt extremity, it would produce a spark and shock which might produce unpleasant effects. This is owing to the fact that electricity will flow rapidly from points, while on a large surface it must accumulate in large quantities before a discharge will occur, or a high degree of *intensity* must take place, which is measured by the length of the spark. *Electrometers* and *electroscopes* measure intensity; pith balls suspended, and repelling each other when electrified, and the gold leaf electrometer, are instances of these instruments. The *quadrant* measures intensity by divergence of the pith ball from the perpendicular. The *balance* electrometer measures amount of excitation by the weights lifted by the attractive force.

Galvanism.

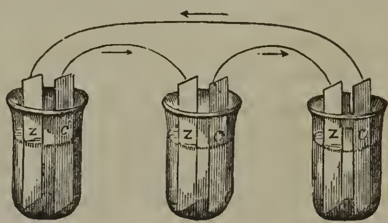
When and by whom discovered? In 1790, by Galvini. He accidentally noticed, in dissecting frogs, that, when the scalpel was in contact with the nerves, and touched another metal in contact with the muscle, contraction took place. He supposed that there was a discharge of electricity as in a Leyden jar, and that the nerves acted as one coating of the jar, the muscles as the other, and that muscular motion was always dependent upon such discharges. Volta denied this, and alleged that the muscle was only an electroscope, indicating the presence of electricity. For the generation of this kind of electricity, two metals or conductors are necessary, and a fluid that acts on, or corrodes one more than another. It is identical with ordinary electricity excited by a machine; this latter, from being insulated, has great *intensity*, but the *quantity* is small. In galvanic development, the *quantity* is large, but the *tension* is not great.

What is a *simple voltaic* or *galvanic circle?* It may be formed by a plate of zinc and a plate of copper, or other metals, placed in a vessel of water with sulphuric acid, and the two metals brought

in contact at their edges, directly, or by means of a wire, and a galvanic current will be excited; hydrogen escaping at the copper plate, while the zinc one will become oxidized. The current sets out from the most to the least oxidizable metal *in the water*, and to the former *out of the water*.

The following exhibits a connection of three simple circles, and the direction of the current: —

Fig. 2.



If ammonia be used in this battery instead of the dilute sulphuric acid, the current will be reversed, on account of the copper being more readily acted upon by the ammonia than the zinc is. Chemical decomposition is necessary to the galvanic excitation, and any two conductors will answer the purpose, so that one is acted upon more easily than the other.

Two liquids and a metal also may form a circle, provided one liquid operates more strongly on one side than the other on the other side of the plate.

A *battery* consists of a great many voltaic circles, or *compound galvanic circles*.

Quantity is produced by the extent of surface of the plates, while *tension* depends upon the number of the plates; either may be increased to a great extent by augmenting the condition for its production. The first is measured by its *chemical* effect, and particularly by its power of decomposition; the latter by its power of passing through imperfect conductors.

The magnetic needle is deflected from its meridian by a galvanic current, and is a true measure of its energy; in fact, it is a *galvanometer*, which is constructed in the same way; the direction of the current is also indicated.

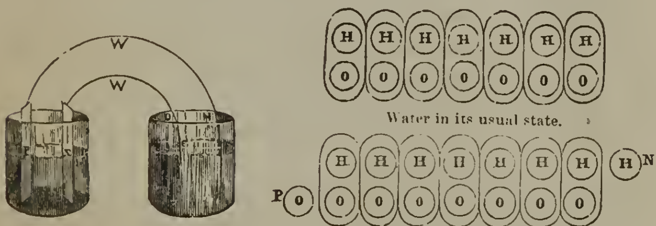
Can heat be produced by galvanism? It can, by increasing the

surface; platinum has been fused by it with great rapidity; charcoal has also been heated to whiteness in vacuo, and it cannot, therefore, be dependent upon combustion.

Electrolization, or *electrolysis*, is the decomposition of a fluid by galvanic action; *electrodes*, or *poles*, of a battery are the points of the circuit where electrical phenomena are manifested, and are usually the extremities.

Electrolytes are substances which are capable of decomposition in this manner; and two conditions are necessary. The substance to undergo decomposition must be a conductor; and it must also be in a liquid form. Water acidulated with sulphuric acid is one substance that may be thus decomposed; and is, therefore, an electrolyte. When decomposed, the oxygen is found at the positive pole, and is, therefore, *electro-negative*, because opposite states attract each other; while the hydrogen is given off at the negative pole, and on the same principle must be *electro positive*. If these gases should be collected, it will be found that the oxygen is only one-half the bulk of the hydrogen, thus proving by analysis that two volumes of hydrogen and one of oxygen are combined in the formation of water. The manner of this decomposition is illustrated by the diagram.

Fig. 3.



Water in its usual state.

Water undergoing electrolysis.

P and Z are the plates immersed; W W the wires leading into a vessel of water; and H and O are the gases given off.

The water is supposed to arrange itself in a molecular condition between the poles or electrodes, a particle of oxygen is evolved at the anode, and its particle of hydrogen, instead of being transferred at once to the opposite electrode, unites with the next particle of oxygen, and displaces the particle of hydrogen with which it was previously united, which, on being displaced, unites with the next

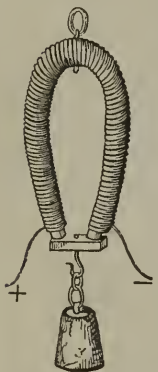
particle of oxygen, and so on to the last, where a particle of hydrogen is thrown off.

There is, then, a propagation of a polar force throughout the molecules of the water, and all other electrolytes, and a series of consecutive decompositions and recompositions produced.

Can *magnetism* be produced by galvanism? It can; and has given rise to the science of *electro-magnetism.* If a current of electricity be passed at right angles to a piece of iron or steel, magnetic polarity is developed, the direction of the current determining the position of the poles. If this current circulate a number of times around the bar, the effect is increased, and an extraordinary magnetic power is soon acquired.

By taking a piece of soft iron, surrounded by a coil of copper wire, bent into a horse-shoe form, and surrounded previously with silk, so as to insulate it, and connecting the two ends of the wire with a battery, it will be found that the two ends of the iron have powerful magnetic properties, capable of sustaining a great weight while the current is closed.

Fig. 4.



The magnetism produced in this way will exhibit the same properties as that of a common magnet, of attraction and repulsion. Magnetism may also be made to call into activity electric currents. Take the two extremities of the coil of the electro-magnet above shown, and connect them with a galvanometer; apply a steel horse-shoe magnet to the ends of the bar, and a current of electricity will be developed, as indicated by the deflection of the needle. When the magnet is removed, the polarity being destroyed in the iron, a second current is produced opposite to the first. In both cases the current is but momentary — a mere wave. By using a powerful magnet, and making an arrangement by which a bar wrapped with the coil can be applied and removed with rapidity, or so that its polarity may be induced and destroyed quickly, magneto-electric currents of great intensity may be produced. This principle has been applied to the construction of machines for medical purposes.

Specific Gravity.

What is specific gravity? It is the relative weight of equal bulks of different bodies.

How is it ascertained? By dividing the weight of the body by the weight of the same bulk of water, which is assumed as unity.

How is the weight of a like bulk of water found? By weighing the substance out of water, and in water, the differences will be the weight of the water displaced.

Suppose the body is lighter than water. Then add the weight necessary to sink it to the weight of the body, and you have the weight of an equal bulk of water, which will enable you to find the specific gravity in the usual manner.

What are the instruments used to ascertain the specific gravity of liquids. *Hydrometers.*

What is assumed as unity in ascertaining the specific gravity of gases? The atmospheric air; and their specific gravity is ascertained on the same principles as liquids and solids.

Nomenclature.

What are the compounds of oxygen called, that do not possess acidity? *Oxides.*

What are they called when they possess *acidity*? *Acids;* and are named from the substance acidified by the addition of *ic*. For instance, sulphuric and carbonic acids are acid compounds of sulphur and carbon with oxygen.

Suppose a base should form two acids with oxygen, what is the one called containing the least quantity of oxygen? It takes the name of the base with the addition of *ous*, as sulphurous acid.

By what name do we denote the simple non-metallic combustibles when united with one another, with a metal, or a metallic oxide? They are known by the addition of *uret* or *ide*, as sulphuret, carburet, and phosphuret of iron, or sulphide, carbide, and phosphide of iron, denoting compounds of sulphur, carbon, and phosphorus with iron.

How are the oxides distinguished from each other? *Protoxide* is the first degree of oxidation; *binoxide* the second; *teroxide* the

third; and the term *peroxide* is often applied to the highest degree of oxidation. *Sesqui*, one and a half, is used to an oxide, the oxygen in which is to that in the first oxide as one and a half to one, or as three to two.

What is usually understood by the term *salt?* A compound resulting from the union of an acid with a base. The definition of a salt, as given by Dr. Hare, is, that it is a soluble compound, containing one or more acids, or corrosive ingredients, the qualities of the ingredients being either neutralized or modified; the name is indicative of the composition.

If the name of the acid terminates in *ic*, the name of the salt terminates in *ate;* if the acid terminates in *ous*, the salt terminates in *ite*. Thus the sulphate, carbonate, and arseniate of potassa are salts of sulphuric, carbonic, and arsenic acids with potassa. The terms sulphite and arsenite of potassa, denote combinations of sulphurous and arsenious acids with potassa.

What is understood by *neutral*, *super*, and *sub salts?* Salts are termed *neutral*, if the acid and base neutralize each other; *super*, if the acid is in excess; and *sub*, if the base is in excess.

Another manner of expressing the relation between acids and bases relates to the atomic constitution of the salt. If there is an equivalent of the acid and alkali, the generic name of the salt is employed without any other addition.

If two or more equivalents of the acid are attached to one of the base, a numeral is prefixed indicating its composition, as the *sulphate* and *bisulphate* of potassa; the *oxalate*, *binoxalate*, and *quadroxalate* of potassa. When the base is in excess, or the acid deficient, it is proposed to use the Greek numerals, *dis*, *tris*, *tetrakis*, to indicate the equivalent of an alkali in a subsalt. In other compounds, where two or more equivalents of a negative element enter, they are distinguished by the Latin numeral, and the Greek numerals are applied to that element regarded as positive. For instance, a *bichloride* contains two equivalents of the negative element chlorine; on the other hand, a *dichloride* signifies that one equivalent of chlorine is combined with two of a positive body.

What is an *amphigen* element? One which has the power of combining with others and forming both acids and bases, as oxygen; thus, it will combine with iron, forming a base FeO, and nitrogen, to form an acid NO^5.

What is meant by a *halogen* salt? It is a substance having the properties of a salt that is composed only of two simple substances. Iodine, chlorine, bromine, fluorine, and cyanogen are the only simple substances that have the property of combining with other simple substances, and forming this class of compounds.

What is meant by *katalysis?* It is the action of *presence* in producing decomposition; as when a body, which possesses what has been termed catalytic force, resolves other bodies into new compounds by mere contact or presence, without itself experiencing any modification.

What is meant by *isomorphous?* It is a term applied to different bodies which have the same crystalline form.

Affinity.

What is understood by *chemical affinity*, or *attraction?* It is that affinity or attraction which is exerted between the minutest particles of different kinds of matter, causing them to combine, and form new bodies, with new properties.

Does it act at *sensible* or *insensible* distances? It acts only at *insensible* distances, or when in apparent contact.

What is an instance of *chemical attraction?* Oxygen and iron forming rust, or an oxide; oxide of iron and sulphuric acid forming a green colored salt, the sulphate of iron.

What is understood by *single elective affinity?* Suppose we have a compound formed by the union of ammonia and oil, and to this we add sulphuric acid, the greater attraction of the ammonia for the sulphuric acid than exists between it and the oil, will cause it to leave the oil, and unite with the acid; this is an instance of single elective affinity, so termed because there appears to be an election, or choice exercised.

What is meant by *double elective affinity?* Suppose two salts having different acids and bases, say carbonate of ammonia and hydrochlorate of lime, be mixed together, the carbonic acid will quit the ammonia, and unite with the lime; the hydrochloric acid will also leave the lime, and unite with the ammonia; so that both original salts will be decomposed, and two new ones formed; this is an instance of double elective affinity.

What leading circumstances characterize chemical action? The

loss of properties of the combining substances, and the acquisition of new ones in the new compound; changes of density, temperature, form, and color.

What circumstances modify the operation of affinity? Cohesion, elasticity, quantity of matter, gravity, pressure of the atmosphere, and the agency of the imponderables.

Do bodies unite in *definite* or *indefinite* proportions? Substances unite in definite proportions, and form but few different compounds with each other; some of them but one, some two, others again unite in three, four, five, and even six, which is the highest number of compounds that any two substances are known to produce. They are governed by three remarkable laws: —

First Law. — The composition of bodies is fixed and invariable.

Second Law. — The relative quantities in which bodies unite may be expressed by proportional numbers.

Third Law.—When one body, A, unites with another body, B, in two or more proportions, the quantities of the latter, united with the same quantity of the former, bear to each other a very simple ratio.

All substances containing only two atoms are called *binary* compounds; those of two binary compounds are called *ternary;* of four, *quarternary;* and so on.

Substances also unite in definite volumes, so that the laws of combination may equally well be deduced from the volumes or from the weights of combining substances, and the composition of gaseous bodies may be as well expressed by measure as weights.

What is understood by *chemical equivalent?* It is a number representing the least combining proportions of a body, which is equivalent to another body, and may be substituted for it in combinations. These combining proportions may be expressed by numbers, in which hydrogen is represented as 1, and they represent relative, and not absolute weights.

What is meant by *isomeric* or *metameric* bodies? Bodies are termed isomeric or metameric which contain the same chemical elements, and in the same ratio, and yet have chemical properties different from each other, as the oil of lemons ($C^{10}H^{8}$), and the oil of copaiba ($C^{10}H^{8}$).

What is the difference between *polymeric* and *metameric* bodies? A body is said to be polymeric of another when the relative pro-

portion of its elements is the same, but which has twice or thrice the equivalent number of the one below it. Thus, oil of turpentine ($C^{20}H^{16}$) is polymeric of the oil of calamus ($C^{10}H^{8}$).

How may the equivalent of compounds be determined? By adding together the numbers representing the equivalents entering into the combination. These numbers are sometimes termed *atomic* weights.

Symbols.

What is a symbol? The first letter of the Latin name of an element, or, if two elements begin with the same letter, a second smaller one is added. Thus, N stands for nitrogen, and Ni for nickel. A symbol itself indicates one equivalent of an element, as Cl, which implies one atom of chlorine.

What are the symbols for the three physical forms of matter? A *solid* is represented in Roman type, as Zn for zinc; a *liquid* is represented in italics, as *HO* for water; and a *gas* by a small hair letter, O for oxygen

How are the symbols of *organic* bodies distinguished from the *inorganic*? By having a line drawn over them, as $\overline{\mathrm{O}}.\ \overline{\mathrm{Pt}}$, which stand for oxalic acid and protein, respectively.

What rule is observed in writing formulas? If it be an amphigen salt, the base is placed before the acid, as in sulphate of soda ($NaOSO^3$). If a halogen salt, the metallic radical is placed before the salt radical, as in the chloride of zinc (ZnCl). In all other cases the body most resembling oxygen is placed on the right of the other element.

When a compound consists of several equivalents of the same elements, how are they multiplied? By placing small figures to the right of the symbols, as C^4H^5O, which is the formula for ether.

How is an uncombined element multiplied? By placing a large figure to the left of the symbol, as 4O, which signifies four equivalents of free oxygen.

When a large figure is placed before a compound, how far does it multiply? To the first comma or plus sign, as $3NaO,PO^5$, which is tribasic phosphate of soda; or, if the symbols are enclosed in a parenthesis, it multiplies all within it, as $4(FeOSO^3)$, which indicates equivalents of sulphate of iron

Is the entire formula of a compound body always expressed? No; it is frequently abbreviated, as Cy for cyanogen, instead of C^2N, which expresses its ultimate composition.

How is the symbol for constitutional water distinguished from that of water of crystallization? Constitutional water is printed in the symbols of its elements, thus, HO, as $NaOCO^2HOCO^2$, which is bicarbonate of soda, the water in it being necessary to its existence. On the other hand, Aq is the symbol for the water of crystallization, as in $Al^2O^33SO^3,KOSO^3+24\ Aq$, the formula for common alum, the crystalline form of which is destroyed by driving off the 24 equivalents of water.

Oxygen.

When was oxygen *discovered?* By Priestly in 1774, and by Scheele a year or two after, without a knowledge of its prior discovery. It was termed *dephlogisticated air*, *empyreal air*, and *vital air.*

How is oxygen *obtained?* It may be obtained from the peroxides of manganese, lead, and mercury, nitre, and chlorate of potash, by exposure to a red heat. It may be obtained from the former by heating it to redness in a gun-barrel, or heating it in a flask with an equal weight of concentrated sulphuric acid, by means of a lamp.

What is the *rationale* of these last two processes? On applying a red heat to the peroxide of manganese it loses one-third of its oxygen, and is converted into the proto and sesqui oxides: thus, $3MnO^2 = Mn^2O^3 + MnO + 2O$

When mixed with sulphuric acid, the peroxide loses a whole equivalent of oxygen, and is converted into the protoxide, which unites with the acid, leaving a sulphate of the protoxide in the retort, thus: $\mathit{HOSO}^3 + MnO^2 = MnOSO^3 + \mathit{HO} + O$.

What is the *rationale* when procured from the chlorate of potash? A retort of glass containing no lead in its composition should be used. The chlorate first becomes liquid, and on an increase of heat is wholly resolved into pure oxygen gas, which escapes, and into a white compound, which is the chloride of potassium, and remains in the retort thus: $KOClO^5 = KCl + 6O$. Or, thus:—

Chlorate of potassa	Chloric acid ClO^5	O^5	$6O$.	6 equiv. oi oxygen.
		Cl		
	Oxide of potassium KO	O		
		K	ClK.	Chloride of potassium.

The oxygen is, therefore, derived partly from the potassa, and partly from the chloric acid. Procured in this way, it is very pure.

By the addition of the black oxide of manganese to the chlorate of potash, it may be obtained at a much lower temperature, and with very simple apparatus; the oxide of manganese, in this case, operates simply by its presence, without undergoing chemical change itself, so that decomposition is effected by katalysis.

What are the *properties* of oxygen gas? It is colorless, insipid, inodorous, refracts light feebly, a non-conductor of electricity, the most perfect electro-negative substance we possess, heavier than atmospheric air, unites with some substances which are said to be oxidized, and are divided into oxides and acids; supports combustion in a high degree, and is necessary in a diluted state to the respiration of animals; pure, it is deleterious. Its specific gravity is 1·102; equivalent 8; and symbol O.

What is understood by *combustion?* In its common acceptation, it means the rapid union of oxygen with a combustible material, attended with the emission of light and heat. But the union of many other substances is also characterized by similar phenomena.

When oxygen unites with another substance in the proportion of one equivalent of each, the compound is called a *protoxide;* if in the proportion of two equivalents of oxygen to one of the other elements, the compound is called a *deut* or *bin*oxide; three, *ter* or *trit*oxide, &c. When the ratio of 1 to $1\frac{1}{2}$, or 2 to 3 exists, the term *sesqui* is employed. Thus:—

FeO, protoxide of iron: FeO^2, the binoxide; FeO^3, tritoxide; Fe^2O^3, the sesquioxide.

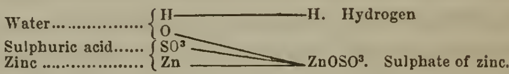
Hydrogen.

When was hydrogen *discovered?* It was first described by Cavendish, in 1766, under the name of inflammable air.

How is hydrogen *procured?* It may be procured tolerably pure by passing the vapor of water over metallic iron, heated to redness, and by putting pieces of iron or zinc into dilute sulphuric acid

What is the *rationale* of these processes? In the former case,

the oxygen of the water unites with the red-hot iron, and the hydrogen is set at liberty, thus: $3Fe + 4HO = F^2O^3 + FeO + 4H$. In the latter, the oxygen of the water unites with the metal, and forms an oxide, which unites with the acid, and forms a sulphate, while the hydrogen of the water is set at liberty, thus: $HOSO^3 + Zn = ZnOSO^3 + H$. Or thus:—



What are the *properties* of hydrogen gas? It is colorless, has neither odor nor taste, is a powerful refractor of light, the lightest body known, will not support respiration, a non-supporter of combustion, highly inflammable, but, like other combustibles, requires the aid of a supporter of combustion, electro-positive, and produces a remarkable alteration in the voice when breathed. If a jet be thrown upon spongy platinum, it is ignited. Its equivalent is 1; symbol H; sp. gr. 0·0689.

What is the product in the combustion of hydrogen? *Water;* which will be exactly equal in weight to the gases disappearing; it gives off very little light in burning. When in contact with oxygen it may be set on fire by flame, a solid body heated to redness the electric spark, and spongy platinum, if thrown on it in a jet.

The amount of heat evolved is very great, as is best exhibited by Hare's compound blowpipe, which is arranged so that the oxygen and hydrogen, emitted from gasometers, are mixed at the point of ignition, and produce the greatest heat known. The Drummond light is formed by a jet of this, ignited and thrown on lime.

What are the chemical relations of water? It has *solvent* properties exceeding any other liquid. It exhibits *feeble acid* properties by uniting with bases and neutralizing them in some degree, as in its union with potash. It also sometimes acts the part of a *base*, and is necessary to the existence of acidity; as an instance of this, dry sulphuric acid exerts no acid properties until united with water. It exists in some salts as *constitutional water*, in which case it is necessary to their existence, and if driven off by heat, the salt is decomposed. Epsom salts is an instance of this.

It is found also in crystals, and necessary to their existence, in the form of what is termed *water of crystallization*.

What is the proportion existing between the oxygen and hydrogen in the formation of water? By measure there is two volumes of hydrogen to one of oxygen: by weight 88·9 oxygen to 11·1 hydrogen, or nearly as 8 parts oxygen to 1 of hydrogen. Its symbol is *HO*.

How many combinations are there of oxygen and hydrogen? Two; one in the proportion to form water, and another, which is the peroxide of hydrogen, HO^2, and contains twice as much oxygen as is contained in water.

The peroxide of hydrogen is a colorless, inodorous, transparent liquid, and has strong bleeching properties. At a temperature above 55° it effervesces with the escape of oxygen gas, and explodes violently at 212°; has a metallic taste, and becomes thick by evaporation. Metals and their oxides decompose it.

Ozone has been supposed to be a new form of peroxide of hydrogen, although it has never been isolated.

Nitrogen, or Azote.

How is nitrogen *procured?* By burning a piece of phosphorus in a jar full of air, inverted over water; the oxygen of the atmosphere unites with the phosphorus, forming meta-phosphoric acid, which is absorbed by the water. Nitrogen remains in the jar, in combination with a small quantity of carbonic acid, which may be removed by agitating it with a solution of pure potassa. Or it may be procured by any other substance which will take the oxygen from the atmosphere, and leave the nitrogen. It was first noticed by Rutherford, in 1772.

What are the *properties* of nitrogen? It is colorless, devoid of taste or smell, more distinguished by negative characters than by any striking properties; non-supporter of combustion and respiration, and not combustible. Its equivalent is 14·06; sp. gr. 0·972; symbol N.

How many *compounds* does nitrogen form with oxygen? Five, besides its combination in the atmosphere, which is considered as a mechanical mixture.

COMPOUNDS OF NITROGEN WITH OXYGEN.

	By volume. N.	O.	By weight.	Equiv.	Symbols.
Nitrous Oxide,	100	50	14·06+8	=22·04	NO
Nitric Oxide	100	100	14·06+16	=30·04	NO^2
Hyponitrous Acid,	100	150	14·06+24	=38·04	NO^3
Nitrous Acid,	100	200	14·06+32	=46·04	NO^4
Nitric Acid,	100	250	14·06+40	=54·04	NO^5

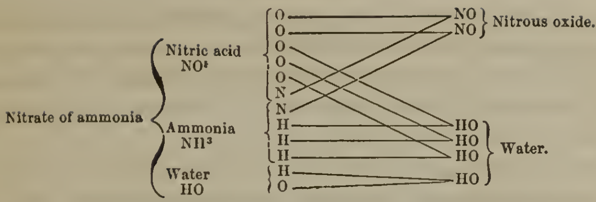
What is understood by the *air* or *atmosphere?* It is that mass of gaseous matter by which the earth is surrounded on all sides, and adheres to it by the force of gravity. Its pressure on the surface of the earth is equal to about 15 pounds to the square inch of surface, which renders it capable of supporting a column of water 34 feet high, and one of mercury 30 inches.

Is the *pressure* of the atmosphere invariably the same? No; it varies at different times, and according to the elevation above the level of the sea, as indicated by a *barometer.*

What are the *component parts* of the atmosphere? It is composed of oxygen 20 or 21 parts; and nitrogen 79 or 80 by volume; it also contains a little carbonic acid. By weight, it is oxygen 23; nitrogen 76; carbonic acid, ammonia, and watery vapor 1. The principal chemical properties are owing to the presence of oxygen.

How is the *protoxide of nitrogen* or *nitrous oxide* procured? By subjecting the nitrate of ammonia to heat, which is decomposed, and the products are protoxide of nitrogen and water.

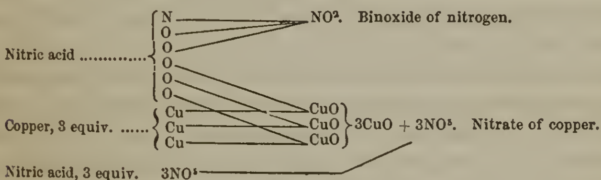
What is the *rationale* of this process? The nitrate of ammonia is composed of nitric acid and ammonia. The nitric acid is composed of one equivalent of nitrogen, and five of oxygen; and the ammonia of one of nitrogen and three of hydrogen; making in all two equivalents of nitrogen, five of oxygen, and three of hydrogen. By the addition of heat their relations are changed, so that the three equivalents of hydrogen unite with three of the oxygen, and form water, leaving two equivalents of oxygen and two of nitrogen, which unite and form the nitrous oxide, thus: $NH^3NO^5 = 3HO + 2NO$; or, considering the nitrate of ammonia to contain one equivalent of water, thus:—



What are the *properties* of nitrous oxide? It is a colorless gas, absorbable by pure water, a supporter of combustion, produces exhilaration when breathed, without being followed by depression or languor. It is what is termed *exhilarating* or *laughing gas.*

How is the *binoxide* procured? By the action of nitric acid on metallic copper; the gas escapes and may be collected over water or mercury.

What is the *rationale* of this process? One portion of nitric acid is decomposed; part of its oxygen oxidizes the copper, while another part is retained by the nitrogen, forming the binoxide or nitric oxide thus: $4NO^5 + 3\mathrm{Cu} = 3\mathrm{CuONO}^5 + \mathrm{NO}^2$. Or thus:



Equivalent 30·04; formula NO^2; sp. gr. 1·039.

What are the *properties* of the binoxide of nitrogen? It is a colorless gas; when mixed with any gaseous mixture containing oxygen, dense suffocating acid vapors of a red or orange color are produced, which are nitrous acid, and are copiously absorbable by water. This peculiarity is a distinguishing *test* for nitric oxide, and is also a test for the presence of free oxygen. It is not possessed of acid properties, and is irrespirable.

How is *hyponitrous acid* produced? By adding binoxide of nitrogen to oxygen in excess, pure potash being present, 100 measures of oxygen combine with 400 of the binoxide, and hyponitrous acid is formed, which unites with the potash.

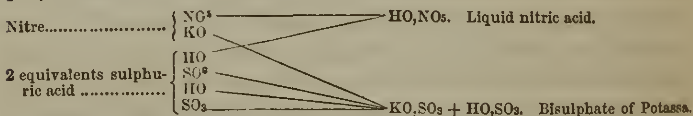
What are its properties? At 0° F., anhydrous liquid, hyponi-

trous acid is colorless, and green at common temperatures, very volatile, passing off in the form of an orange vapor; on admixture with water, it is converted into nitric acid and binoxide of nitrogen, thus: $3NO^3$ and $HO = NO^5$ and $2NO^2$. Formula NO^3; equivalent 38·04; sp. gr. (of gas) 1·72.

How is *nitrous acid* obtained? By introducing 200 measures of binoxide of nitrogen into a dry exhausted glass vessel, with 100 of oxygen; also by subjecting the nitrate of lead, carefully dried, to a red heat, thus: $PbONO^5 = PO + O + NO^4$.

What are its properties? Its vapor is of an orange-red color, irrespirable, has acid properties, is absorbed by water, the binoxide of nitrogen being disengaged, and nitric acid remains in the water, thus: $3NO^4$ yield $2NO^5$ and NO^2. Formula NO^4; equivalent 46·04; sp. gr. (of gas) 3·18; of liquid 1·45. Its vapor may be condensed by a freezing mixture, into a liquid, in which state it is anhydrous acid, and pungent to the taste, gives a yellow stain to the skin, and is very corrosive. At 0° it is nearly colorless, and at 32° it is yellow. When mixed with a considerable quantity of water, it is instantly resolved into binoxide of nitrogen, which escapes with effervescence, and into nitric acid, which unites with the water.

How may *nitric acid* be procured? By adding binoxide of nitrogen slowly over water, to an excess of oxygen gas. It is composed of 100 measures of nitrogen, and 250 of oxygen. For commerce it is procured by decomposing some salt of nitric acid with oil of vitriol; and common nitre or saltpetre is generally employed, thus: —



Can nitric acid exist in an insulated state? Yes; but it is difficult to obtain it pure; it exists in a dry crystalline form, and exerts no acid reactions unless developed by water. In commerce it is generally known by the name of *aqua fortis*.

What are its *properties?* It is highly acid, largely diluted it reddens litmus paper permanently, unites with alkalies forming salts, which are called *nitrates*. In its purest concentrated form it is colorless, and has a specific gravity of 1·5 or 1·51 At 1·5 it

contains 20 per cent. of water, for which it has a great affinity, acts powerfully on substances disposed to unite with oxygen, decomposes vegetables, the oxygen of the acid uniting with their hydrogen, forming water, and also with the carbon, forming carbonic acid. All the salts of nitric acid are soluble in water.

TABLE OF DIFFERENT KINDS OF NITRIC ACID.

Nitric acid of sp. gr.	1·52—NO_5+HO,	14	per cent.	of water.
" "	1·50—NO_5+3HO,	20	"	"
" "	1·42—NO_5+4HO,	40	"	"

What are the *tests* for *nitric acid* and the *nitrates?* When uncombined, it is readily detected by its strong action on copper and mercury, emitting ruddy fumes of nitrous acid.

Another, is to mix the supposed nitric acid, or nitrate, with dilute sulphuric acid, add to this some pure zinc, and set fire to the hydrogen as it is evolved; if nitric acid is present the flame will have a greenish white tint, which is owing to the presence of the binoxide of nitrogen.

Another, is to add to the supposed nitrate a drop of sulphuric acid heated in a test tube, and then add a crystal of morphia, which, if nitric acid be present, will become of an orange red followed by a yellow color. The sulphuric acid in this case should also be tested previously.

Carbon.

In what form is carbon usually presented to us? In the form of charcoal and the diamond.

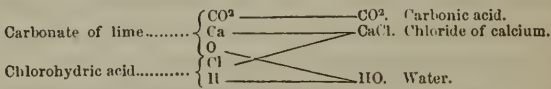
How is it *procured?* By heating wood to redness in a close vessel. The volatile parts are expelled, and the carbonaceous part remains, which is called *charcoal.* If bones are used instead of wood, we have *animal charcoal* or *ivory black.* The diamond is found in a pure state.

What are the *properties* of charcoal? It is highly combustible, hard, and brittle, conducts heat slowly, a good conductor of electricity, very refractory in the fire if the air is excluded, absorbs air, or other gases, largely, and yields them again on the application of heat; the proportion, however, varying in different gases, and absorbs the odoriferous and coloring particles of animal and vegetable substances.

Animal charcoal is mostly used when we wish to decolorize fluids, by being finely pulverized, and having the fluid filtered through it. The equivalent of carbon is 6, symbol C.

What are the compounds of carbon and oxygen? There are three; carbonic oxide, CO, oxalic acid, C_2O_3, and carbonic acid, CO^2.

How is *carbonic acid*, or fixed air, *procured?* It may be expelled from common limestone or magnesia (which are carbonates), by the action of heat or acids, thus: $CaOCO^2 + SO^3 = CaOSO + CO^2$. Or thus:—



It is also formed during respiration, fermentation, and combustion. When it accumulates in wells, &c., it is called *choke damp.*

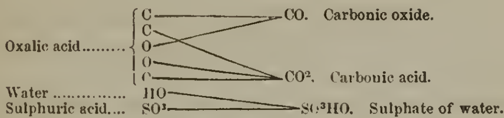
What are the *properties* of carbonic acid? It is colorless, inodorous, elastic, condensible into a liquid under a pressure of 36 atmospheres, may be frozen into a white solid, will not support respiration or combustion, incombustible, renders lime-water turbid by the formation of carbonate of lime, absorbable by water, the quantity absorbed being very much increased by pressure; and, when the pressure is removed, it escapes with an effervescence. The agreeable, lively taste of beer, porter, ale, mineral water, &c., is owing to its presence. It unites with alkaline substances, and the salts so formed are termed *carbonates.* It is easily displaced from all its combinations by the hydrochloric and the stronger acids, when it escapes with effervescence. Formula CO^2; equivalent 22; sp. gr. 1·52.

How is *carbonic oxide procured?* By exposing two parts of well dried chalk and one of pure iron filings to a red heat, and washing the gas evolved with lime water, or an alkaline solution, which absorbs the carbonic acid and leaves the carbonic oxide.

Another mode is to mix binoxalate of potash with five or six times its weight of sulphuric acid, and heat it in a retort; an effervescence soon ensues, which is a mixture of carbonic acid and carbonic oxide, and may be separated in the same manner as in the preceding process.

What is the *rationale* of this last process? Oxalic acid is a

compound of equal parts of the elements of carbonic acid and carbonic oxide, and they cannot exist in the form of oxalic acid, unless in combination with water, or some other substance. The sulphuric acid then unites with both the potassa and water of the binoxalate, and the oxalic acid being thus set free is decomposed, thus:— $HOC^2O^3 + SO^3 = HOSO^3 + CO + CO^2$.



What are the *properties* of carbonic oxide? It is colorless, insipid, has no acid properties, inflammable, burning with a lambent blue flame, and irrespirable. Formula CO; equivalent 14; sp. gr. ·973.

CARBONIC OXIDE SERIES.

Carbonic oxide	CO.
Carbonic acid	$CO + O$.
Oxalic acid	$2CO + O$.
Chlorocarbonic acid (phosphene gas)	$CO + Cl$.
Croconic acid	$5CO + H$.
Mellitic acid	$4CO + H$.
&c., &c.	

Sulphur.

In what form do we generally find sulphur? It is found in the region of volcanoes, generally in a massive state, sometimes crystallized; it is also found combined with the metals, such as silver, copper, antimony, lead, and iron. From its combination with iron, which is called *iron pyrites*, it may be procured in large quantities by exposure to a red heat in a close vessel, when it is sublimed.

What are the *properties* of sulphur? It is solid, brittle, of a greenish-yellow color, has a peculiar odor when rubbed, tasteless, crystallizable, a non-conductor of electricity, negatively electrified by friction, fused at 216° F.; if the temperature is raised to 320° it thickens and acquires a reddish tint, 428° to 482° it is so tenacious that the vessel may be inverted without causing it to change its place; if raised still higher, to its boiling point, it again becomes

liquid; at the temperature of 428°, if poured into water, it becomes ductile. It is volatile at 550° to 600°, and is condensed unchanged at lower temperatures. Its equivalent is 16; symbol S; sp. gr. 1·99.

What are the compounds of sulphur and oxygen? There are seven.

COMPOUNDS OF SULPHUR AND OXYGEN.

	Sulphur. Oxygen. Equiv.	Formula
Sulphurous acid	$16 + 16 = 32$	SO^2
Sulphuric acid	$16 + 24 = 40$	SO^3 or $SO^2 + O$.
Hyposulphurous acid	$32 + 16 = 48$	S^2O^2 or $SO^2 + S$.
Hyposulphuric acid	$32 + 40 = 72$	S^2O^5 or $2(SO^2) + O$.
&c., &c.		

What are the properties of *sulphurous acid?* It is gaseous, colorless, transparent, has a pungent suffocating odor, an acid taste, and bleaching properties; it reddens litmus at first, and then bleaches it. It has a strong affinity for oxygen, and will precipitate metals which have a weak affinity for oxygen from their solutions. It combines with metallic oxides, and forms salts called sulphites. Formula SO^2; equivalent 32; sp. gr. 2·21.

How is it *procured?* It is formed by the combustion of sulphur in the atmosphere, or dry oxygen gas; it is also evolved mixed with carbonic acid when combustible substances, containing carbon, are heated with strong sulphuric acid; and by heating sulphuric acid with most of the metals, with copper and mercury particularly, it yields a very pure gas, thus: $2SO^3 + Ca = CaOSO^3 + SO^2$. It may be obtained liquid, by transmitting dry, pure gas through a glass tube surrounded by a freezing mixture. When exposed to cold, in a moist state, a crystalline solid is formed.

How is *sulphuric acid procured?* One method is to subject to a strong heat the sulphate of iron (copperas or green vitriol); the sulphuric acid of the salt passes over in combination with the water which it contains, thus: $4(FeOSO^3)\ HO = HO^3\ 2SO^3 + 2SO^3 + 2Fe^2O^3$.

Procured in this way, it is called the *fuming sulphuric acid* of Nordhausen, on account of the white vapors which it emits on exposure to the air, and from the place in Germany where it is manufactured.

Anhydrous sulphuric acid may be procured from this by heating it gently in a retort, and surrounding the receiver adapted to it with a mixture of snow and salt, in which it is condensed into a white crystalline solid.

The most common process for procuring sulphuric acid, is to burn sulphur, mixed with one-eighth its weight of nitrate of potash, in a furnace arranged so that the current of air supporting combustion will conduct the products into a leaden chamber containing water, which becomes saturated with the sulphuric acid formed in the process.

What is the *rationale* of this process? The nitric acid of the nitre yields oxygen to a portion of sulphur, and converts it into sulphuric acid, which combines with the potassa of the nitre; at the same time the greater part of the sulphur forms sulphurous acid by uniting with the oxygen of the air.

The nitric acid, by yielding a portion of its oxygen to the sulphur, is converted into binoxide of nitrogen; which, coming in contact with the air at the moment of its separation, is converted into red nitrous acid vapors. The gaseous product in the leaden chamber, therefore, is sulphurous and nitrous acids, atmospheric air, and watery vapor. From these elements a crystalline compound is formed, consisting of sulphuric acid, hyponitrous acid, and water; and, when this solid comes in contact with the water of the chamber, it is decomposed, the sulphuric acid is absorbed by the water, and nitrous acid and binoxide of nitrogen escape; the latter of which, coming in contact with the air, is converted into nitrous acid. This nitrous acid is again intermixed with sulphurous acid and aqueous vapor, and gives rise to a second portion of the crystalline compound, which undergoes the same changes as the first. The following diagram represents the formation of the crystalline compound: —

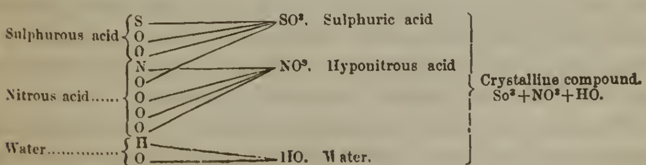


TABLE OF HYDRATES OF SULPHURIC ACID.

Nordhausen	$2SO^3 + HO$	Specific gravity		1·95
Purest oil of vitriol	$SO^3 + HO$	"	"	1·85
	$SO^3 + 3HO$	"	"	1·76
	$SO^3 + 4HO$	"	"	1·68
	&c. &c.			

What are the properties of sulphuric acid? As usually obtained, it is a dense, colorless, oily fluid; boils at 620°; specific gravity 1·847; very corrosive; sour, reddens litmus, and separates all other acids from their union with the alkalies. Chloride of barium, or any salt of baryta, is a test for it and its soluble combinations, and will form a white precipitate, the sulphate of baryta.

Phosphorus.

How is phosphorus *procured?* By igniting bones in an open fire until all the animal matter is destroyed, leaving only a white substance, which is principally the phosphate of lime; reduce this to a fine powder, and digest with strong sulphuric acid and water, sufficient to give the consistence of a thin paste. The phosphate of lime is decomposed; a sulphate and a soluble superphosphate of lime is formed. The superphosphate of lime is to be dissolved in warm water, and separated from the sulphate by filtration, and evaporated to the consistence of syrup, then mixed with one-fourth its weight of powdered charcoal, and heated in an earthen retort, with the beak of the retort put into water, in which the vapor of the phosphorus is condensed, of a reddish-brown color, owing to the presence of the phosphuret of carbon. It may be purified by a second distillation.

What is the *rationale* of this process? When the superphosphate of lime and charcoal are mixed, and heat applied, the oxygen of that part of the phosphoric acid, which constitutes the superphosphate, unites with the charcoal, and forms carbonic acid and carbonic oxide gases; phosphorus is distilled over, and phosphate of lime with redundant charcoal, remains in the retort.

What are the *properties* of phosphorus? It is colorless and transparent when pure; a soft solid at ordinary temperatures, has a waxy lustre when cut with a knife, distils at 550°, very inflammable, undergoes slow combustion at common temperatures when

exposed to the air, and emits a white vapor of an alliaceous odor. Its equivalent is 32; symbol P; and sp. gr. 1·77.

What are the *compounds* of phosphorus and oxygen? The oxide of phosphorus, consisting of two equivalents of phosphorus, and one of oxygen, P_2O; the hypophosphorous acid, 1 eq. of phosphorus to 1 of oxygen, PO; the phosphorous acid 1 eq. of phosphorus to 3 of oxygen, PO_3; and the phosphoric, pyrophosphoric, or metaphosphoric acid, which is 1 eq. of phosphorus and 5 eqs. of oxygen, PO_5.

There are several varieties of this acid which differ very much in their reaction with other substances, but whose composition is the same as to the amount of water existing in each.

TABLE OF ACIDS.

Phosphoric acid (dry)	PO^5	
Phosphoric acid (common)	$PO^5 + 3HO$.	Tribasic.
Pyrophosphoric acid	$PO^5 + 2HO$.	Bibasic.
Metaphosphoric acid	$PO^5 + HO$.	Monobasic.

How is *phosphoric acid procured?* By decomposing phosphate of baryta with sulphuric acid.

What are its *properties?* It is viscid, inodorous, colorless, liquid, reddens vegetable blues, and, when heated to redness, corrodes glass or porcelain.

How many classes of salts does phosphoric acid form, and what are they? The *monobasic*, $NaOP^2O^5$; the *bibasic*, $2NaO,P^2O^5$; and the *tribasic*, $3NaO,P^2O^5$; corresponding with the equivalents of water held by each, as is shown in the above table.

Which class is the most common? The tribasic; which gives a yellow precipitate with nitrate of silver.

What class of phosphates exists in plants and animals? The tribasic.

How many series of salts does the tribasic acid form, and how are they expressed? Thus, in the soda series we have one with *acid reaction*, $NAO,2HO,PO_5$; another *neutral*, $2NAO,HO,PO_5$; the third *alkaline*, $3NAO,PO_5$.

Of the above, the subsalt is the common phosphate of soda of the shops. In all fluids of the bodies of. animals having an acid reaction, the first of these salts is found, and in those possessing an alkaline reaction the last is found.

Boron.

How is boron *procured?* It was first obtained by subjecting boracic acid to the action of a powerful galvanic battery. But it may be procured in larger quantities by heating boracic acid with potassium, by which the boracic acid is deprived of its oxygen, and the boron liberated, thus: $BO^3 + 3K = 3KO + B$.

What are the *properties* of boron? It is of a dark olive color, has neither taste nor smell, and is a non-conductor of electricity. It is not soluble in water, alcohol, ether, or oils, does not decompose water, bears a strong heat in close vessels without fusing, or being changed, except that its density is increased. If heated to 600° it takes fire, oxygen disappears, and boracic acid is formed. Its equivalent is 10·9; symbol B; sp. gr. about 2.

What are the *compounds* of boron and oxygen? *Boracic acid*, BO^3, is the only compound of boron and oxygen.

Where is it found, and how is it procured? It is found, as a natural product, in some of the hot springs, and is a constituent of datolite, boracite, and borax, which is a compound of boracic acid and soda, and is a biborate. It is procured by adding sulphuric acid to a solution of purified borax in four times its weight of boiling water. The sulphuric acid unites with the soda, and the boracic acid is deposited, on cooling, in crystals, which may be purified by washing, dissolving them in boiling water, and by recrystallization, thus: $NaO2BO^3 + SO^3 = NaOSO^3 + 2BO^3$.

What are the *properties* of boracic acid? In crystals, it is a hydrate, slightly soluble in water, very soluble in alcohol, and the solution, when set on fire, burns with a green flame, which is a sure test for the presence of boracic acid; sp. gr. 1·479, inodorous, bitter taste, reddens litmus, and, with alkaline carbonates, produces effervescence. In its hydrous state, if gradually exposed to a high heat, its water of crystallization is expelled, and a fused mass remains, which will bear a white heat without sublimation, and on cooling, forms a hard, transparent glass, which is anhydrous boracic acid. It absorbs water, and loses its transparency if exposed to the air. It is sometimes used as a flux, from its being very fusible and communicating this property to other substances.

Silicon.

How is silicon *procured?* It was first procured by Berzelius, by the action of potassium on fluo-silicic acid gas; but a more convenient process is from the double fluoride of silicon and potassium, or sodium, previously dried, and placed in a glass tube with potassium, to which a spirit lamp is applied. The potassium unites with the fluorine and the silicon is set at liberty, thus: $2SiF^3,3KF + 6K = 9KF + 2Si$. To render it perfectly pure, it should then be heated to redness, and digested in dilute hydrofluoric acid.

What are the *properties* of silicon? It is of a dark nut-brown color, without metallic lustre, non-conductor of electricity, incombustible, not dissolved or oxidized by sulphuric, nitric, hydrochloric, or hydrofluoric acids; but nitric and hydrofluoric acids mixed dissolve it readily. Its equivalent is 21·3; symbol Si.

What is the composition of *silicic acid?* In 100 parts there are 48·4 of silicon, and 51·6 oxygen, by weight.

Where is the silicic acid found, and how is it procured? It exists in great profusion in nature, under the names of silica and siliceous earths. It forms a part of many minerals, and, under the name of quartz, forms mountainous masses. It is the principal ingredient in sand-stones, flint, chalcedony, &c. &c. It may be procured by igniting pure rock crystal, throwing it, while red hot, into water, and reducing it to a fine powder.

What are the *properties* of silicic acid? As procured above, it is a light white powder, feels rough and dry when rubbed between the fingers, insipid and inodorous; sp. gr. 2·69. It is very fixed in the fire, but may be fused by the hydro-oxygen blowpipe, insoluble in water, does not affect tests for acids, but, in its chemical combinations, acts the part of an acid and displaces carbonic acid from the alkalies by the aid of heat. The nature of its combinations with the alkalies depends upon the proportions in which they are united. One of these combinations, which is one part silicic acid and three of carbonate potassa, is deliquescect and easily dissolved in water, in this condition it has been called the *liquor of flints or liquor silicum.*

By reversing the proportions the result is the well-known article

glass. Every kind of glass is a compound of silicic acid with a base or bases; therefore, a silicate. The quality generally depending upon the purity of the materials, and in flint glass, besides the pure silicic acid and alkali, there is added some of the oxides of lead; it is, therefore, a double salt, composed of bisilicate of potassa, and bisilicate of oxides of lead. Its equivalent is 45·3.

Selenium.

How is selenium formed and how is it procured? It generally occurs in combination with iron pyrites, also in some volcanic products, as a sulphuret, and it is sometimes found combined with several of the metals. It may be obtained from the sulphuret by mixing it with eight times its weight of peroxide of manganese, and exposing the mixture to a low red heat in a glass retort, the beak of which extends into water. The sulphur is oxidized by the oxide of manganese, and the selenium is sublimed.

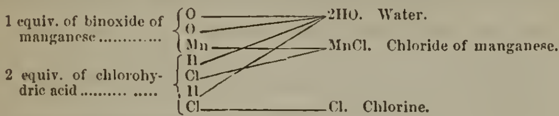
What are its properties? It is a brittle opaque solid, having neither taste nor odor, of a metallic lustre when in mass, and when in powder of a deep red color. It softens at 212°, and may be drawn into fine threads; conducts heat and electricity imperfectly, and is insoluble in water. Exposed to the flame of a blowpipe it colors the flame of a light blue color, and exhales a strong odor of decayed horseradish; which may be considered as characteristic of the presence of selenium, whether alone or in combination. Its equivalent is 39·6; symbol Se; sp. gr. 4·3.

What are the compounds of selenium and oxygen? There are three: the oxide of selenium, SeO; selenious acid, SO^2; and selenic acid, SeO . The selenic acid is analogous in composition, and many of its properties, to sulphuric acid, and that similarity extends also to their compounds with alkaline substances.

Chlorine.

How is chlorine gas *obtained*? By the action of hydrochloric or muriatic acid, and the peroxide of manganese, in the proportion of two parts of the former to one of the latter; the chlorine escapes with effervescence, without the application of heat; but much more rapidly when heat is applied.

What is the *rationale* of this process? The hydrochloric acid consists of chlorine 2 eqs., and hydrogen 2 eqs.; the oxide of manganese consists of manganese 1 eq., and oxygen 2 eqs. In the reaction which takes place, 1 eq. of chlorine unites with the 1 eq. of manganese, forms the chloride of manganese, and 1 eq. of chlorine is set at liberty; and the 2 eqs. of oxygen and 2 eqs. of hydrogen unite and form water. So that the result is chloride of manganese, water, and chlorine, which is set at liberty, thus: $2HCl + MnO^2 = 2HO + MnCl + Cl$. Or:—



What are the *properties* of chlorine gas? It has a yellowish-green color, astringent taste, and disagreeable smell. It is irrespirable, even when largely diluted with air, and emits heat and light when strongly compressed. By the application of about four atmospheres of pressure, it becomes a limpid liquid of a bright yellow color. It is absorbable by water, which yields it when heated. It presents the phenomena of combustion when brought in contact with some substances, and the result is a chloride, or an acid containing chlorine. It has a very strong affinity for hydrogen, is negatively electric, has no acid properties, has a great affinity for metals, and a powerful bleaching property. In its application to bleaching the presence of water is necessary, and hydrochloric acid is generated during the process; from which we infer that the water is decomposed, the hydrogen uniting with the chlorine, and the oxygen is liberated, which occasions the bleaching. The compounds of chlorine which are not acid are termed chlorides. The test for chlorine is nitrate of the oxide of silver, which produces a white precipitate. Its equivalent is 35·42; symbol Cl; sp. gr. 2·47.

What compound does chlorine form with hydrogen? It forms the *hydrochloric* or *muriatic acid*, which is 1 eq. of chlorine to 1 of hydrogen, HCl.

How may this acid be *prepared?* In a gaseous state, it may be procured by putting a strong liquid solution of the acid into a glass, and heating it until it boils, when the gas is evolved, and may be

collected over mercury. Another method is to mix equal weights of liquid sulphuric acid and sea salt, and apply heat.

What is the *rationale* of these processes? In the former, the acid dissolved in water is simply expelled by heat.

In the latter the water is decomposed, its oxygen unites with the sodium of the chloride of sodium, or sea salt, and forms soda, the hydrogen unites with the chlorine and forms the hydrochloric acid, which escapes, and the sulphuric acid unites with the soda. The water in this process is supplied by the sulphuric acid. The result, therefore, is sulphate of soda and hydrochloric acid, thus: $NaCl + HOSO^3 = NaOSO^3 + HCl$. Or:—

Sulphuric acid .... SO^3 — $NaOSO^3$. Sulphate of soda.
Water .... { HO
Chloride of sodium ... { Cl — ClH. Chlorohydric acid.
Na

Under what circumstances will the elements of hydrochloric acid, when brought into contact, unite? When an electric spark is passed through the mixture, by the presence of flame, a red hot body, or spongy platinum. By exposure to diffused light they unite slowly, but the direct solar rays, like electricity, flame, &c., produce a sudden inflammation accompanied with an explosion.

In what manner is the acid procured in a *liquid* state? By passing a current of gas into water as long as any of it will be absorbed, we procure a concentrated aqueous solution.

What are the *properties* of hydrochloric acid? In a gaseous state it is colorless, has a pungent odor, and an acid taste. In a temperature of 50°, and under a pressure of 40 atmospheres, it is liquid. It is irrespirable, incombustible, and a non-supporter of combustion. Heat will not alter it chemically, but galvanism will decompose it; hydrogen will be found at the negative pole, and chlorine at the positive. It has a powerful attraction for water, which causes a white cloud to appear, where it is liberated into the atmosphere, owing to its combination with the aqueous vapor; ice also liquefies instantly, if introduced into a jar containing it, and the gas is rapidly absorbed. On introducing a jar containing the gas into water, the absorption takes place so rapidly, that the water is forced up with the same rapidity as if it were a vacuum. During the absorption, heat is given out.

How can we determine the quantity of this acid contained in its

solutions? By ascertaining the quantity of pure marble dissolved by a given weight of each. Every 50·6 grains of marble correspond to 36·42 of real acid.

What are the *properties* of the hydrochloric acid of commerce? It has a yellow color, and contains impurities, which are usually nitric and sulphuric acid, and the oxide of iron. If pure, it is a colorless liquid, emits white vapors if exposed to the air, very sour, reddens litmus, and neutralizes alkalies. It freezes at 60°, and boils at 110°, giving off the pure hydrochloric acid gas freely.

It is decomposed by substances yielding oxygen easily.

What combination of hydrochloric acid is used in dissolving gold and platinum? It is a mixture of two parts of the hydrochloric and one of the nitric acids, and is commonly termed *aqua regia.*

What chemical action takes place in forming a solution of gold by this mixture? The nitric and hydrochloric acids decompose each other, and produce water, nitrous acid, and chlorine; the solvent power is dependent on the chlorine, which is liberated.

What are the compounds of chlorine and oxygen? They are the hypochlorous acid, ClO; the chlorous acid, ClO_3; hypochloric acid, ClO_4; chloric acid, ClO_5; and the perchloric acid, ClO_7.

How is *hypochlorous acid* procured? Hypochlorous acid, or *euchlorine*, may be best procured by pouring peroxide of mercury, in fine powder, and mixed with twice its weight of distilled water, into bottles filled with chlorine gas. By agitation, the chlorine is completely absorbed. The oxide of mercury is decomposed, both its constituents combining with chlorine, the mercury forming corrosive sublimate, and the oxygen hypochlorous acid, thus, $HgO + 2Cl = HgCl + ClO$. The acid may then be separated by distillation, which should be done at a temperature below 212°, as it is decomposed at that heat; or it may be best performed under reduced pressure. The acid thus procured may be concentrated by a second distillation.

What are the *properties* of hypochlorous acid? It is a transparent liquid of a slightly yellow color when concentrated; has a strong penetrating odor, an exceedingly active action on the skin, similar but greater than that of nitric acid; high bleaching properties, when concentrated very liable to be decomposed, chlorine being evolved, and chloric acid produced; this effect is promoted by light, and produced instantly by the direct rays of the sun;

also, by agitation with angular bodies; a portion of pounded glass produces brisk decomposition, when thrown into this acid. It is a powerful oxidizing agent, particularly of the non-metallic elements, which are readily brought to their highest degree of oxidation.

How is *chlorous acid* procured? By heating in a flask a mixture of four parts chlorate potassa, three of arsenious acid, and twelve of nitric acid, previously diluted with four parts of water. The heat must be applied cautiously, by means of a water bath. The acid comes over in the form of a greenish yellow gas, having strong bleaching properties; combines slowly with bases forming crystallizable salts; water absorbs five or six times its own volume of the gas.

How is *hypochloric acid* procured? By making 50 or 60 grains of chlorate of potassa into a paste with strong sulphuric acid, putting it into a glass retort, and applying heat by means of warm water kept below 212°, when a gas of a bright yellowish-green color is disengaged, which has an aromatic odor without the smell of chlorine, and is rapidly absorbed by water, to which it imparts its tint

What is the *rationale* of this process? The sulphuric acid decomposes a part of the chlorate of potassa, and liberates chloric acid, which, at the moment of separation, resolves itself into hypochloric acid and oxygen; the last of which passes over to the acid of the undecomposed chlorate of potassa, and is converted into perchloric acid. The resulting compounds are bisulphate and perchlorate of potassa, and hypochloric acid, thus: $3KOClO^5+4SO^3=2KO^2SO^3+KOClO^7+2ClO^4$.

What are the *properties* of hypochloric acid? It has bleaching properties, and exerts violent action on combustibles. Phosphorus takes fire with an explosion when introduced into this gas. A temperature of 212° causes a violent explosion. It may be liquefied by cold. No compound of it with a base has yet been discovered.

How is *chloric acid* procured? To a dilute solution of chlorate of baryta add weak sulphuric acid, precisely sufficient for combining with the baryta; an insoluble sulphate of baryta is formed and precipitated; and pure chloric acid remains in the liquid, thus: $BaOClO^5+SO^3=BaOSO^3+ClO^5$.

What are the *properties* of chloric acid? It reddens vegetable blue colors, has a sour taste, and forms neutral salts with alkaline bases called chlorates. It has no bleaching properties, a circumstance which distinguishes it from chlorine, hypochlorous acids, and chlorous acids. It does not give a precipitate with a solution of the nitrate of silver. It may be concentrated by a gentle heat to an oily consistence. In this highly concentrated state it has a yellowish tint, an odor of nitric acid, sets fire to dry organic matter, and converts alcohol into acetic acid.

It is easily decomposed by deoxidizing agents.

It may be distinguished by forming a salt with potassa, which crystallizes in tables, has a pearly lustre, deflagrates like nitre when thrown on burning charcoal, and yields chloric acid by the action of concentrated sulphuric acid.

How is *perchloric acid* procured? By adding dilute sulphuric acid to perchlorate of potassa, and applying heat to the mixture; white vapors arise that condense as a colorless liquid in the receiver, which is a solution of perchloric acid, thus: $KOClO^7 + SO^3 = KOSO^3 + ClO^7$. It may be obtained in a solid form, by mixing it with strong sulphuric acid and distilling. It hisses when thrown into water, similar to red-hot iron; forms a compound with potassa very slightly soluble in water, which is the perchlorate of potassa, and may be distinguished from the chlorate by not becoming yellowish on the application of hydrochloric acid. The primary form of its crystal is a right rhomboidal prism.

How is the *quadrochloride* of *nitrogen* procured? Dissolve an ounce of hydrochlorate of ammonia in 12 or 16 ounces of hot water, when it has cooled to 90° invert a wide-mouthed glass bottle, full of chlorine, into it. The chlorine is absorbed, it acquires a yellow color, and in a few minutes globules of a yellow fluid float like oil upon its surface; when they acquire the size of a small pea, they sink to the bottom of the liquid, and should be collected in a leaden saucer placed under the mouth of the bottle.

What is the *rationale* of this process? The ammonia is decomposed by the chlorine, hydrochloric acid is generated by the hydrogen of the ammonia uniting with a part of the chlorine, while the nitrogen of the ammonia unites with another part of the chlorine, thus: $NH^4Cl + 7Cl = 4HCl + NCl^4$.

What are the *properties* of the quadrochloride of nitrogen? It

is one of the most explosive compounds known. It is not congealed by a mixture of snow and salt, may be distilled at 160°, explodes between 210° and 212°, contact with some combustibles causes detonation at common temperatures, particularly oils, both volatile and fixed. The products of the explosion are chlorine and nitrogen. This compound is 4 eqs. of chlorine to 1 of nitrogen, or, as stated by Berzelius, 3 eqs. of chlorine to 1 of nitrogen.

What are the *compounds* of *chlorine* with *carbon?* The sesquichloride of carbon, C^2Cl^3; the protochloride, CCl; and the dichloride, C^2Cl.

How is *sesquichloride* of *carbon* procured? By exposing olefiant gas to chlorine; a combination takes place between them, and an oily liquid is generated, which is a compound of carbon, hydrogen, and chlorine. Put this into a vessel containing chlorine gas, and expose it to the direct rays of the sun; the chlorine decomposes the liquid, hydrochloric acid is liberated, and the carbon unites with the chlorine at the moment of separation.

What are the *properties* of the sesquichloride of carbon? It is solid at common temperatures, has an aromatic odor, a non-conductor of electricity, and a powerful refractor of light; sp. gr. 2; fuses at 320°; it may be distilled without change, and assumes a crystalline form when it condenses.

How is the *protochloride* of *carbon* procured? By passing the vapor of perchloride through a red hot glass tube filled with pieces of rock crystal, it is partially decomposed; chlorine and protochloride of carbon being the result.

What are the *properties* of *protochloride* of *carbon?* It is a limpid colorless liquid, has a density of 1·55, does not congeal at 0°, and is converted into vapor at 160° or 170°. It may be distilled, but exposure to a red heat resolves it into its elements.

What are the *characteristics* of the *dichloride* of *carbon?* It is of a white color, in the shape of small, soft, adhesive fibres, and has a peculiar odor resembling spermaceti.

What are the compounds of *chlorine* and *sulphur?* The dichloride, S^2Cl; and the protochloride, SCl.

What are the compounds of chlorine and phosphorus? The pentachloride of phosphorus, PCl_5; and the terchloride, PCl_3.

How is the *pentachloride* of *phosphorus* procured? By inflaming phosphorus in dry chlorine, the perchloride collects inside

of the vessel. It is white and very volatile. By heating it under pressure and cooling, it yields transparent prismatic crystals.

How is the *terchloride* of phosphorus procured? By heating the perchloride with phosphorus; also by passing the vapor of phosphorus over corrosive sublimate contained in a glass tube.

What are the *properties* of the terchloride of phosphorus? It is a clear liquid, like water, of sp. gr. 1·45, emits acid fumes when exposed to the air, owing to the decomposition of aqueous vapor. On mixing with water, a mutual decomposition takes place, heat is evolved, and a solution of hydrochloric and phosphorous acids is obtained.

How is *chlorocarbonic acid*, or *phosgene gas* procured? By exposing equal parts, by measure, of chlorine and carbonic oxide gases to sunshine, a combination ensues, and a contraction to half the volume takes place.

What are the *properties* of chlorocarbonic acid gas? It is colorless, has a strong odor, and reddens dry litmus paper, combines with gaseous ammonia, and forms a white solid salt, therefore, has acid properties. Water decomposes it, and the result is hydrochloric and carbonic acids.

What compound does *chlorine* form with *boron*? It forms the terchloride; and it is procured by putting recently prepared boron into chlorine, when it takes fire spontaneously, and a colorless gas, the chloride of boron, is formed, which is absorbable by water, and undergoes double decomposition at the same moment, the result of which is hydrochloric and boracic acids.

What compound does *chlorine* form with *silicon*? The terchloride, which may be procured by heating silicon in a current of chlorine gas. The product is condensed into a colorless liquid, which, by the addition of water, is converted into hydrochloric and silicic acids.

Is chlorine a simple or compound substance? It is a simple body, because it cannot be decomposed by any known means.

IODINE.

Where is iodine found? It is found in many mineral springs, in combination with sodium and potassium; it is also found in the water of the Mediterranean, in the oyster, and some other marine

molluscous animals, in sponges, and in most kinds of sea weed. It has also been found in the mineral kingdom in combination with silver.

How is it *procured?* It is procured from kelp, an impure carbonate of soda, obtained by incinerating sea weeds. Carbonate of soda is prepared from the kelp; and the residual liquor contains iodine in combination with potassium or sodium, which may be separated by the addition of sulphuric acid and binoxide of manganese; by the application of heat the iodine is then sublimed, and may be collected in cool glass receivers; thus: with iodide of sodium, $2SO^3 + MnO^2NaI = MnOSO^3 + NaOSO^3 + I$. Or:

Iodide of sodium { Iodine .... Iodine.
{ Sodium
2 sulphuric acid { Sulphuric acid
{ Sulphuric acid .... Sulphate of soda.
Peroxide of manganese .... { Oxygen
{ Protoxide of manganese .... Sulphate of manganese.

What are the *properties* of iodine? It is soft, friable, solid, has a bluish color, metallic lustre, and crystalline appearance, resembling micaceous iron ore. It is fused at 225°, and ebullition takes place at 347°. If moisture is present, it is sublimed rapidly at a temperature below boiling water. Its vapor is of a rich violet color, from which it derives its name.

It is a non-conductor of electricity, and negatively electric. It is very sparingly soluble in water, but very soluble in alcohol and ether. It has a strong affinity for the metals and most of the non-metallic combustibles, producing compounds, termed iodides.

The *test* for iodine is starch; but the iodine must be in a free condition, and the solution cold. Its equivalent is 126·3; symbol I; sp. gr. 4·94.

What compound does iodine form with hydrogen? It forms the hydriodic acid, which is 1 eq. of iodine to 1 eq. of hydrogen.

How is *hydriodic acid* procured? It may be formed by the direct union of hydrogen with the vapor of iodine transmitted through a porcelain tube at a red heat. It may also be procured by the action of water on the iodide of phosphorus, which gives the hypophosphoric and hydriodic acids, the latter of which passes over as a colorless gas, thus: $PI^2 + 2HO = 2HI + PO^2$.

What are the properties of hydriodic acid *gas?* It has a sour

taste, reddens vegetable blue colors, and produces white fumes when mixed with the air.

What is its action on the metallic oxides? Water and an iodide of the metal is formed, thus: $KO + HI = KI + HO$.

Its salts are called iodides.

What are the compounds of iodine with oxygen? The *oxide of iodine, iodous acid, iodic* and *periodic acid.*

How is the oxide of iodine and iodous acid procured? By mixing the vapor of iodine and oxygen gas considerably heated, a yellow matter of the consistence of solid oil is produced, which is regarded as the oxide of iodine; and, if the supply of oxygen be continued, it is converted into a yellow liquid, which is the iodous acid.

How is the iodic acid procured? By decomposing iodate of barytes by means of sulphuric acid. The following is the rationale: $BaOIO^5 + SO^3 + BaOSO^3 + IO^5$.

What are the *properties* of iodic acid? It is a white, semi-transparent solid, has a strong, astringent, sour taste, inodorous, and is anhydrous. Its compounds are called iodates.

Bromine.

How is bromine procured? From bittern, by the action of chlorine, which, by its superior affinity for the metallic radicals, liberates the bromine. The bromine is then taken up by ether, and acted on by potash, which is converted into the bromide and bromate, the bromate being converted into bromide by means of heat. The potassium is acted on by sulphuric acid and peroxide of manganese; the following change occurring: $2SO^3 + MnO^2 + KBr = MnOSO^3 + KOSO^3 + Br$.

What are the *properties* of bromine? At common temperatures it is a blackish-red liquid. Its odor is very disagreeable, and resembles chlorine. It is congealed at 4°, and is brittle. It emits at common temperatures red-colored vapors, resembling nitrous acid, and boils at 116·5°. It resembles oxygen, chlorine, and iodine, in being negatively electric. It is soluble in water, alcohol, and ether, supports combustion under some circumstances, and is very destructive to life. It has not been decomposed, and is very analogous in its chemical relations to iodine and chlorine. It can

generally be detected by means of chlorine, which displaces bromine from its compounds. Its equivalent is 78·4; sp. gr. 2·9; symbol Br.

What *compound* does bromine form with hydrogen? The hydro-bromic acid, and may be produced by mixing the vapor of bromine with hydriodic acid, hydrosulphuric acid, or phosphuretted hydrogen gas, when decomposition takes place, and hydrobromic acid is formed.

What are the properties of *hydrobromic acid?* It is a colorless gas, of an acid taste and pungent odor, irritates the glottis, and when mixed with moist air yields white vapors. It is decomposed by chlorine; hydrochloric acid gas is produced, and bromine is deposited. The salts of bromine are called bromides.

What *compounds* are formed with bromine and oxygen? The *bromic acid* is the only known compound.

How is it *procured?* By decomposing a dilute solution of the bromate of baryta with sulphuric acid. The sulphate of baryta is precipitated, the bromic acid remains in solution, and may be concentrated by slow evaporation, but cannot be entirely deprived of water without being decomposed. The following is the rationale: $BaOBO^5 + SO^3 = BaOSO^3 + BrO^5$.

What are the *properties* of *bromic acid?* It has an acid taste, but not corrosive, very little odor, reddens litmus at first, and then destroys its color. It is analogous to iodic, chloric, and nitric acids. Its composition is 1 eq. of bromine to 5 eqs. of oxygen.

How is the *chloride* of *bromine* procured? By passing a current of chlorine through bromine, and condensing the resulting vapors by a freezing mixture.

What are the *properties* of chloride of bromine? It is a volatile fluid of a reddish-yellow color, disagreeable taste, penetrating odor, and causes a discharge of tears from the eyes. Metals burn in its vapor, and chlorides and bromides are formed.

What other *compounds* does bromine form? It forms two compounds with iodine, two with phosphorus, one with carbon, and one with silicon.

FLUORINE.

How is fluorine *procured?* By passing fluoride of boron over minium heated to redness, and collecting the gas in a dry vessel;

another mode is to mix fluoride of calcium and peroxide of manganese with sulphuric acid.

What are the *properties* of fluorine? It is a yellowish-brown gas, resembles chlorine in odor, bleaches, is negatively electric, and has a powerful affinity for the metals and hydrogen. Its equivalent is 18·68; sp. gr. 1·2; symbol F.

What *compound* does fluorine form with hydrogen? The hydrofluoric acid, which is 1 eq. of fluorine to 1 of hydrogen.

How is it *procured?* By adding concentrated sulphuric acid to fluor spar (which is a fluoride of calcium), reduced to a fine powder. The acid distils over on applying heat, and must be collected in a leaden receiver surrounded with ice. The result is hydrofluoric acid, which comes over, and the sulphate of lime remains in the retort, thus: $HOSO^3 + \mathrm{CaF} = \mathrm{CaOSO^3} + HF.$

What are the properties of *hydrofluoric acid?* It is a colorless liquid at 32°; if exposed to the air, it flies off in dense white fumes, produced by its combination with the atmosphere; has a powerful affinity for water, and a very pungent vapor. It is the most destructive to animal matter of all known substances, its application being followed by a malignant ulcer; it corrodes glass, and fluosilicic acid gas is produced.

When diluted with three or four times its weight of water, it is suitable for etching on glass. It has the properties of a powerful acid, reddens litmus, has a strong sour taste, neutralizes alkalies, and unites with metals forming compounds, called fluorides.

How is *fluoboric acid gas* obtained? By heating a mixture of 12 parts of sulphuric acid with 2 of fluor spar and 1 of vitrified boracic acid, in a flask. It may also be obtained by heating hydro-fluoric and boracic acids in a metallic retort.

What the the *properties* of fluoboric acid gas? It is colorless, has a penetrating pungent odor, reddens litmus, and forms salts with alkalies, called fluoborates. It has a very strong affinity for water, which it will take from any gas containing aqueous vapor, thus affording a delicate test for it in gases. Water absorbs it, and forms a strong caustic solution.

How is *fluosilicic acid* procured? By mixing 2 parts of strong sulphuric acid, 1 of fluor spar, and 1 of sand, or pounded glass; on the application of heat, it is disengaged, and may be collected

over mercury. The following are the changes: $3SO^3 + SiO^3 + 3CaF = 3CaOSO^3 + SiF^3$.

What are the *properties* of fluosilicic acid? It is a colorless gas, does not support combustion, destroys animal life, and unites with the watery vapor of the atmosphere, forming a white cloud.

Ammonia.

What is the composition of *ammoniacal gas?* It is a compound of nitrogen; 1 equivalent to 3 of hydrogen.

How is it *procured?* It may be procured from any salt of ammonia by the action of a pure alkali, or alkaline earth. Equal parts of the hydrochlorate of ammonia and caustic lime are generally employed; heat is applied, the ammonia is given off, and the residue is chloride of calcium and lime, the lime being added in excess. Thus: $NH_4Cl + CaO = CaCl + HONH_3$. Or:—

Sal ammoniac, or chloride of ammonia...................... $\left\{ \begin{array}{l} NH^4 \\ Cl \end{array} \right.$ $\longrightarrow$ HO, NH^3. Ammonia.

Lime .... $\left\{ \begin{array}{l} O \\ Ca \end{array} \right.$ $\longrightarrow$ $CaCl$. Chloride of Calcium.

A highly concentrated solution of ammonia is obtained by transmitting a current of the gas into water, as long as it will absorb it. To exhibit the gas pure, it must be collected over mercury.

What are the *properties* of ammonia? In a gaseous form it is colorless, powerfully pungent, irritates the eyes and nose, irrespirable when pure, a non-supporter of combustion, slightly combustible in oxygen gas, and a mixture with oxygen detonates by the electric spark, water being formed, and nitrogen set free. The gas may be liquefied at a temperature of 50°, and under a pressure of 6·5 atmospheres, forming a transparent colorless liquid. It is highly alkaline, forms salts decomposable by being heated with the fixed alkalies or alkaline earths, or by a red heat. If combined with a volatile acid, the compound may be sublimed unchanged. It has a powerful affinity for water, which absorbs 780 times its bulk, the sp. gr. of which is diminished to 0·936. The liquid solution is clear, colorless, and possesses the peculiarities of the gas itself.

How may *free* ammonia be detected? By the odor, its temporary action on turmeric paper, which it stains brown, and the color

soon reappears, owing to its volatility; and by its forming dense fumes when a glass rod, moistened with hydrochloric acid, is brought near it; these white fumes are the hydrochlorate of ammonia.

How many compounds of nitrogen and hydrogen are there? Three: as follows:

	Nitrogen. Hydrogen.	
Amidogen	$N + 2H$ or NH^2.	Symbol Ad.
Ammonia.	$N + 3H$ or NH^3.	Formula $Ad + H$.
Ammonium....................	$N + 4H$ or NH.	" $Ad + 2H$.

What is *ammonium?* It is a hypothetical metal, the base of ammonia. It has never been isolated, but has been inferred to exist, because an amalgam is formed with mercury, by a galvanic current, which resembles an amalgam formed with a metal. The base of the salts formed of ammonia is supposed to be an oxide of this radical, because oxy-acids do not unite with bases which contain no oxygen, while oxy-acids do unite with ammonia and form ammoniacal salts. Its formula would be NH^4, and that of its oxide $NH^4 + O$; eq. $18 + 8 = 26$.

Compounds of Hydrogen and Carbon.

What are the known compounds of hydrogen and carbon? *Light carburetted hydrogen, olefiant gas, etherine, paraffine, eupione, rose, oil stearine, wax oil, benzoin, naphtha, oil of turpentine, citrine, camphene, oil of copaiva, juniper oil, lemon oil, savin tree oil, black pepper oil, naphthaline, paranaphthaline, and idrialine.*

What is the proper chemical name for *light carburetted hydrogen?* The *dicarburet* of *hydrogen.* Other names, frequently used, are *heavy inflammable air*, the *inflammable air of marshes*, and *hydro-carburet.*

Where is it found, and how is it obtained? It is formed in stagnant pools, from the decomposition of vegetable matter, and may be procured by stirring the mud at the bottom, and collecting it in inverted vessels as it rises. Obtained in this way, it contains a small quantity of carbonic acid gas. It may also be obtained by heating acetate of potash with hydrate of baryta. The following

is the *rationale;* $KOC^4H^3O^3 + BaOHO = KOCO^2 + BaOCO^2 + 2CH^2$.

What are its *properties?* It is colorless, tasteless, has very little smell, gaseous, a non-supporter of combustion or respiration, inflammable, and burns with a yellow flame. With a sufficient portion of atmospheric air, or oxygen, it forms a detonating compound, water and carbonic acid being formed when it is detonated.

The *fire damp*, so destructive in coal mines when ignited, is composed of this gas.

Upon what principle is Sir Humphrey Davy's safety-lamp constructed to prevent the explosion of this gas? It is found that the flame cannot pass through a narrow tube, however short, provided its diameter is sufficiently reduced. Now a piece of wire gauze may be regarded as an assemblage of these tubes, and flame will not penetrate it; therefore, if a common oil lamp is surrounded with a piece of this gauze, it will burn in the explosive mixture, without communicating combustion to the gas externally.

What is the composition of *olefiant gas*, and why is it so called? It is composed of 2 eqs. of carbon and 2 eqs. of hydrogen, united to form 1 eq. of the gas; and is called olefiant gas, because it forms an oil-like liquid with chlorine. Formula C^2H^2; equivalent 14; sp. gr. ·980.

How is it *procured?* By heating a mixture of alcohol and sulphuric acid, in the proportion of one part of the former to four of the latter; effervescence ensues, and olefiant gas passes over.

What are the properties of *olefiant gas?* It is colorless, tasteless, and inodorous, a non-supporter of combustion and respiration, inflammable, burning with a dense white light, and forms an explosive mixture with oxygen, or atmospheric air. It is decomposed by a succession of electric sparks, and by being transmitted through red-hot porcelain tubes. A mixture of two parts of chlorine, and one of olefiant gas, takes fire on the application of flame, the result of which is hydrochloric acid, and the deposition of charcoal; but if they are allowed to remain at rest, they enter into direct combination, and a yellowish oil is produced.

Upon what does the *flame* of candles, lamps, gas lights, culinary fires, &c., depend? The compounds of carbon and hydrogen.

How may they be *procured* for the purpose of gas lights? By

the destructive distillation of bituminous coal, wood, oil, tar, or other inflammable substances.

Upon what does the *illuminating power* of these compounds principally depend? This power is in proportion to the quantity of carbon condensed into a volume, provided there is a sufficient supply of oxygen to consume it; otherwise, the excess of carbon renders the flame smoky.

Hydrogen and Sulphur.

What are the *compounds* formed by hydrogen and sulphur? There are two; hydrosulphuric acid, HS; and the persulphuret of hydrogen, HS_2.

How is *hydrosulphuric acid*, or *sulphuretted hydrogen*, as it is generally called, procured? By heating sesquisulphuret of antimony with four or five times its weight of hydrochloric acid.

What is the *rationale* of this process? The chlorine of the hydrochloric acid unites with the antimony of the sesquisulphuret, forming a sesquichloride, and the hydrogen of the hydrochloric acid unites with the sulphur of the sesquisulphuret, and forms hydrosulphuric acid, thus: $Sb^2S^3 + 3HCl = S^2Cl^3 + 3HS$.

It may also be obtained by the action of an acid with water on the sulphuret of iron (iron pyrites). When chlorohydric acid is used, the following is the reaction: —

When sulphuric acid is used, it is as follows: —

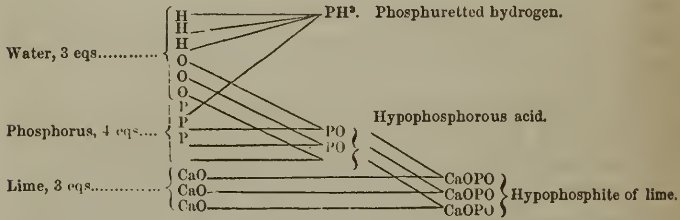
Formula, HS; equivalent, 17; sp. gr. 1·18.

What are the *properties* of hydrosulphuric acid? It is a colorless gas, reddens moist litmus, has a very offensive taste and odor, similar to putrid eggs, a non-supporter of respiration and combustion, combustible, water and sulphuric acid being the products, and sulphur is deposited. It may be readily distinguished by its

odor, tarnishing silver, and the character of its precipitate with solutions of arsenious acid, tartar emetic, or salts of lead. Its salts are called hydrosulphates.

Hydrogen and Phosphorus

How is *phosphuretted hydrogen* procured? By the action of strong hydrochloric acid on phosphuret of calcium. The following is the reaction when water, lime, and phosphorus are heated together: —



What are its *properties?* It is a transparent, colorless gas, of an offensive odor and bitter taste; it is a non-supporter of combustion and animal life. It detonates with oxygen at the temperature of 300°, by the electric spark, and by diminished pressure.

If the beak of a retort from which this gas issues is plunged under water so that bubbles of it may rise through the liquid, each one, on reaching the surface, will burst into a flame, and form a ring of dense white smoke, which enlarges as it ascends, presenting a beautiful appearance characteristic of this gas. It has been known as the *Will-o'-the-wisp.*

Nitrogen and Carbon.

What compound is formed between nitrogen and carbon? *Cyanogen* or *bicarburet* of *nitrogen.*

Formula, NC^2, or Cy; equivalent $14 + 12 = 26$; sp. gr. 1·81.

How is cyanogen *procured?* By heating bicyanide of mercury in a porcelain retort, and collecting the product over mercury.

What are the *properties* of cyanogen? It is a colorless, transparent, irrespirable gas. It is limpid, liquid at the temperature of 45°, and under a pressure of 3·6 atmospheres. It will not support

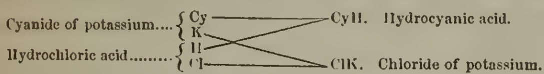
combustion, but burns with a beautiful flame. It is carbon 2 eqs., and nitrogen 1 eq. It has a strong tendency to unite with elementary substances, in this respect resembling chlorine; it is a halogen body, and its compounds are called *cyanides*.

What compound is formed by cyanogen and hydrogen? *Hydrocyanic* or *prussic* acid.

Formula, C^2NH, or CyH; equivalent, $26 + 1 = 27$; sp. gr. (liquid) 0·6767.

Hydrocyanic acid is obtained in the distillation with water, of bitter almonds, apple seeds, the kernels of peaches, and plums, leaves of the cherry laurel, and other plants.

How else is it *obtained*, and what are its properties? By the action of hydrochloric acid upon cyanide of mercury, thus: $HgCy + HCl = HgCl + HCy$. Cyanogen will also unite with hydrogen under the same circumstances that chlorine does; as follows:—



It is colorless, liquid, has an odor resembling peach leaves, very volatile, highly poisonous, and possesses slight acid properties.

Cyanic Acid. C^2NO, or CyO; equivalent 34.

If cyanide of potassium is heated in the air, both the elements take oxygen from the air, and a cyanate of potassa is formed (CyO,KO). The potassa may be removed and the cyanic acid left with water. It is analogous to many other compounds of carbon, nitrogen, and oxygen, which are said to be isomeric with it.

Cyanate of Ammonia. This compound has some interest on account of being isomeric with *urea*, one of the organic constituents of the urine. Its formula is $CyO,NH^3 + HO$, or $C^2NO,NH^4 + O$; and corresponds with the formula of urea, $C^2N^2H^4O^2$.

Fulminic Acid. Formula Cy^2O^2; equivalent 68. It is formed by the action of hyponitrous acid on alcohol in the presence of a salt of silver or mercury. It has not been isolated. The *fulminate of silver* is formed by putting silver in nitric acid, and, when dissolved, adding alcohol The latter becomes oxidized, being converted into aldehyde and oxalic acid; while the nitric acid is converted into hyponitrous acid, by imparting a portion of its oxygen to the alcohol, which then reacts on some undecomposed

alcohol, forming hyponitrous ether, water, and fulminic acid; this latter then unites with the oxide of silver, which crystallizes out in small white plates, which is the *fulminate of silver*, and is one of the most explosive mixtures known to the chemist.

What are the *tests* for cyanogen? It has the odor of peach blossoms. The soluble salts of silver give a precipitate by hydrocyanic acid, of a white color, which is the cyanide of silver, and becomes black by exposure; it is necessary, however, to be sure that neither chlorine nor bromine is present. If a compound containing cyanogen be heated with an alkali and a persalt of iron, a blue precipitate is obtained. If a fluid containing cyanogen be placed in a capsule over a flame, and a solution of sulphuret of ammonium added, the heat will cause the cyanogen to rise in vapors, which will unite with the sulphur, and form sulphocyanogen; this unites with the ammonium, and forms the sulphocyanide of ammonium. Then place a drop of a solution of a persalt of iron on this, and a blood-red spot is obtained, which is the sulphocyanide of iron, and is a certain test.

METALS.

What are the *characteristics* of metals? They are conductors of electricity and heat, electro-positive, opaque, generally good reflectors of light, and possess a peculiar lustre called metallic.

What is the *number* of the metals? Forty-eight.

What metals possess the property of *malleability*? Gold, silver, copper, tin, platinum, cadmium, lead, zinc, iron, nickel, potassium, sodium, and frozen mercury.

What are the metals which possess the property of *ductility*? Gold, silver, iron, and copper are the only ones capable of being drawn into wire with facility.

What is meant by the term *calx*? It is the product of the oxidation of a metal when heated in the air.

What is meant by the *reduction* of a metal? It is the process by which metallic compounds are changed to their metallic state.

What are the *means* used in reducing metals? Heat, the united agency of heat and combustible matter, the galvanic battery, and by the action of deoxidizing agents on their solutions.

What are the oxides of metals called which are capable of uniting with acids and forming *salts?* They are called alkaline or salifiable bases, and are generally the protoxide.

Have metals an affinity for *chlorine?* They have a powerful affinity, and in many instances unite so as to present the phenomena of combustion; and will frequently displace oxygen from its union with the metals.

What are the general *characteristics* of the metallic chlorides? Most of them are solid at common temperatures, fusible by heat, and crystallize on cooling. Some of them may be sublimed without change; they are for the most part colorless, have no metallic lustre, and have the appearance of salts.

Have the metals an affinity for *iodine?* They have a strong affinity, and most of these compounds are not decomposable by a red heat in close vessels.

Have the metals an affinity for *sulphur?* They have a strong tendency to unite with it, and the union may be accomplished by heating the metal with sulphur, by igniting a mixture of a metallic oxide and sulphur, and by several other processes.

How are the metals *divided?* Into *two* classes.

Class 1*st.* Those which yield alkalies and earths by oxidation.
Class 2*d.* Those the oxides of which are neither alkalies nor earths.

The *first class* comprises *thirteen metals*, which have been arranged into three orders: —

Order 1*st.* The metallic bases of the alkalies. They are *potassium*, *sodium*, *lithium*, and *ammonium*.

Order 2*d.* The metallic bases of the alkaline earths. These are *barium*, *strontium*, *calcium*, and *magnesium*.

Order 3*d.* The metallic bases of the *earths*. They are *aluminum*, *terbium*, *erbium*, *glucinum*, *yttrium*, *thorinum*, and *zirconium*.

The *second class* comprises *twenty-nine metals*, and may be arranged into three orders: —

Order 1*st.* The metals which decompose water at a red heat, or with an acid at ordinary temperatures. They are *manganese*, *iron*, *zinc*, *cadmium*, *tin*, *cobalt*, *chromium*, and *nickel*.

Order 2*d.* The metals which do not decompose water at any temperature, and the oxides of which are not reducible to a metallic

state by heat alone. They are *arsenic, vanadium, molybdenum, tungsten, columbium, antimony, uranium, cerium, bismuth, titanium, tellurium, copper, tantalum,* and *lead.*

Order 3*d.* The metals the oxides of which are reduced to the metallic state by a red heat. They are *mercury, silver, gold, platinum, palladium, rhodium, osmium,* and *iridium.*

Metals of the Alkalies.

Potassium.

How is potassium *procured?* It may be procured by subjecting moistened hydrate of potassa to a galvanic battery, and the potassium will be found at the negative pole. A more abundant supply may be obtained by bringing fused hydrate of potassa in contact with turnings of iron heated to whiteness in a gun-barrel. Another method is to mix iron filings and charcoal with potassa, in an iron bottle; in both cases the potassium is sublimed, and may be collected. The rationale is that the iron and charcoal abstract oxygen from the potassa, and the potassium is liberated.

But the method now more commonly practised is that of obtaining it from ignited or carbonized cream of tartar, intimately mixed with charcoal in coarse powder, which, on the application of heat, is resolved into carbonic oxide and metallic potassium; the latter of which should be received in naphtha. The following is the *rationale:* $KOCO^2 + 2C = 3CO + K$.

What are the *properties* of potassium? It is solid at common temperatures, perfectly fluid at 150°, soft and malleable at 50°, and brittle at 32°; undergoes sublimation at a low red heat without change, provided there is no oxygen present, and is similar in lustre to mercury. Its prominent chemical property is its affinity for oxygen, which it combines with rapidly in the air, and by contact with ice or fluids containing oxygen, so that to preserve it, it must be kept in tubes hermetically sealed, or under the surface of liquids which contain no oxygen, such as naphtha, oil of copaiba, &c. Its equivalent is 39; sp. gr. 0·86; symbol Po or K.

What are the *compounds* of potassium and oxygen? They are the protoxide, KO; and the teroxide, KO^3.

What are the properties of the *protoxide of potassium, potash,* or *potassa?* *Anhydrous potassa* is a white solid, highly caustic,

fuses at a temperature a little above redness, and is not decomposed or volatilized by a very high heat. It has a great affinity for water, and forms three compounds with it, with the disengagement of heat during the combination. These compounds are called *hydrates*.

The *hydrate of potassa*, $KO + HO$, also called *caustic potassa*, and *potassa fusa*, is prepared by adding lime to the solution of the carbonate of potassa; the carbonate of lime being precipitated while the potash remains in solution; this is concentrated by evaporation, and poured into moulds. It is a white, very *deliquescent* solid, soluble in water and alcohol. It may further be distinguished by adding tartaric acid in excess to a salt of potassa dissolved in cold water, and a white precipitate, the bitartrate of potassa, is formed. It may also be precipitated by perchloric acid, the perchlorate being nearly insoluble; and a solution of the chloride of platinum produces a yellow precipitate. There is also a light gelatinous precipitate by silicated hydrofluoric acid.

How is the *teroxide of potassium* formed? By burning potassium in the open air, or in oxygen gas, an orange-colored substance is formed, which is the teroxide of potassium.

How is the *iodide of potassium* procured? It may be formed by heating potassium in contact with iodine; the union of which takes place with the evolution of light and heat. But, for procuring it in quantity, the preferable mode is to add iodine to a hot solution of pure potassa, until the alkali is neutralized; by this process iodide of potassium and iodate of potassa are generated; evaporate this to dryness, and expose in a platinum crucible to a red heat, which will decompose the iodate, leaving the iodide of potassium, thus: $6KO + 6I = KOIO^5 + 5KI$; which, on being heated, is resolved into iodide of potassium, thus: $KOIO^5 + 5KI = 6KI + 6O$.

What are the *properties* of the iodide of potassium? It is easily fusible, rises in vapor at a heat below redness, very soluble in water and alcohol, and deliquescent in a moist atmosphere.

What are some of the most important salts of potassa? *Carbonates*, *sulphate*, *nitrate*, and *chlorate*.

The common *pot* and *pearl ashes* are an *impure carbonate*, procured by lixiviating the ashes of inland plants, and evaporating to dryness; purified by redissolving and boiling.

The *salt of tartar* is a *pure carbonate*, prepared by the decomposition of cream of tartar at a high heat. $KO + CO^2$.

The bicarbonate, KO,CO^2, $HOCO^2$, or $KOHO,2CO^2$, may be formed by passing a stream of carbonic acid through a solution of the carbonate; it is less soluble than the carbonate. For commerce, it is prepared by exposing the carbonate to carbonic acid and moisture by spreading it thinly on frames, by which it absorbs water and carbonic acid, and increases in weight about 34 per cent. In this form it is known as *sal æratus*.

The *sulphate*, $KO+SO^3$, is the residue remaining in the retort, after the preparation of nitric acid. The *bisulphate*, ($KOSO^3$ $HOSO^3$ or $KOHO, 2SO^3$), is more soluble, and has acid properties.

The *nitrate*, $KO+NO^5$, called also *nitre* and *saltpetre*, is found in some soils, and is also manufactured from artificial nitre-beds. Crystals, six sided prisms, very soluble, contain water confined mechanically; hence the *decrepitation* when thrown upon hot coals. If heated, it is converted into a *nitrite*, and oxygen is given off, but a high heat entirely decomposes it. It is an important portion of *gunpowder*, by imparting oxygen to the other ingredients, charcoal and sulphur. When gunpowder is burned, the oxygen of the nitre unites with the carbon, and forms carbonic oxide; with the sulphur, forming sulphurous acid gas, and nitrogen is set free; the sulphuret and the sulphocyanide of potassium are also formed.

The *chlorate*, $KO+ClO^5$, possesses remarkable *deflagrating* properties, and yields oxygen largely when heated.

Silicate, KO,SO^3; silicic acid unites in different proportions. If the alkali be in excess, the salt will be soluble in water, and the solution is called the *liquor of flints*, or soluble glass. If the silicic acid be in excess, the salt formed is *glass*, which, when pure and colorless, is essentially a silicate of potash and lime. It may be made to assume by metallic oxides a great variety of colors.

Sodium.

How is sodium *procured?* By the same processes by which we obtain potassium, substituting soda for the potassa.

What are the *properties* of sodium? It has a strong metallic lustre, in color similar to silver, is soft at common temperatures, fuses at 200°, and is vaporized at a red heat. It is oxidized by

water like potassium. Its equivalent is 23; sp. gr. 0·972; symbol So or Na.

What are the *compounds* of sodium and oxygen? They are the protoxide, NaO; and the sesquioxide, Na^2O^3.

How is the *protoxide* of sodium, or soda, *obtained*, and what are its *properties?* It may be obtained by the oxidation of sodium in air or water, from the ashes of sea weeds, or common salt. *Anhydrous*, it is a gray solid, difficult of fusion, and very similar to potassa in both its sensible and chemical properties, but may be distinguished from it by its forming with sulphuric acid a salt easily recognised as Glauber's salt, or sulphate of soda. Its salts are all soluble in water, cannot be precipitated, and, on exposing them by means of a platinum wire to the blowpipe, a rich yellow color is imparted to the flame.

How is the *sesquioxide* of sodium obtained? By heating sodium to redness in oxygen gas. It is of an orange color, with neither acid nor alkaline properties, and is decomposed by water into soda and oxygen.

How is the *chloride of sodium* procured? It may be formed by burning sodium in chlorine, by heating sodium in hydrochloric acid, and also by neutralizing soda with hydrochloric acid. It is found in nature under the name of rock salt, and in sea water, of which it forms a large part; also in many saline springs

What are the *properties* of chloride of sodium? It has an agreeably saline taste, fuses at a red heat, forms a transparent brittle mass on cooling, deliquesces in a moist atmosphere, but not in a dry one, and is decomposed by sulphuric acid, hydrochloric acid being set at liberty, and sulphate of soda formed. It possesses the property in a very high degree of preserving meat from putrefaction, and is used extensively in the arts.

What are the *oxysalts of soda?* They are the following: —

	Soda. Acids.	Equivalents.	
Carbonate	$NaO,CO^2 + 10HO$	$31 + 112$	$= 143$
Bicarbonate	$NaO,CO^2 + HOCO^2$	$40 + 44$	$= 84$
Sulphate	$NaO,SO^3 + 10HO$	$31 + 40 + 90$	$= 161$
Bisulphate	$NaO,SO^3 + HOSO^3$	$40 + 80$	$= 120$
Nitrate	NaO,NO^5	$31 + 54$	$= 85$
Chlorate	NaO,ClO^5	$31 + 75{\cdot}5$	$= 106{\cdot}5$
Phosphate	Polybasic		
Biborate	$NaO2BO^3 + 10HO$	$31 + 69{\cdot}8 + 90$	$= 190{\cdot}8$

The *carbonate* is obtained from the ashes of sea plants by lixiviation and evaporation; also from common salt, by the addition of sulphuric acid, the sulphate of soda is formed, from which the carbonate may be procured. The crystals usually contain 10 equivalents of water. It effloresces; melts in its own water of crystallization when heated; and, although a neutral salt, has a powerful alkaline reaction.

Bicarbonate, called also *supercarbonate*, may be prepared by passing a stream of carbonic acid gas through a saturated solution of neutral carbonate. It is a double salt, consisting of carbonate of soda and the carbonate of water. The carbonate loses 9 equilents of water in becoming bicarbonate, and becomes a white powder.

Sulphate, commonly called *Glauber's salt*, exists in sea water, and is a residue in the preparation of hydrochloric acid, by the action of sulphuric acid on the chloride of sodium in water. Sulphuric acid, added to carbonate of soda, will produce it pure. Crystals are four-sided prisms, with dihedral summits, efflorescent, melt in their own water of crystallization by heat, and soluble in twice their weight of cold water.

Nitrate, obtained naturally and artificially in the same way that nitrate of potassa is obtained. Crystal, rhomb, does not effloresce, because it contains no water of crystallization, but is deliquescent. It yields oxygen to combustibles more slowly than the nitrate of potassa.

Chlorate resembles the chlorate of potassa in all respects.

The *Haloid salts of sodium* are the *chloride*, *iodide*, *bromide*, &c.

What are *tests* of sodium? The compounds of potassium are the only ones liable to be confounded with those of sodium. Soda gives a yellow tinge to flame. Its salts are generally soluble and efflorescent. The bichloride of platinum forms a precipitate with potassa, and not with soda. The only insoluble salt of soda is the antimoniate; while the antimoniate of potash is soluble.

Lithium.

How is lithium *procured*? By decomposing lithia by means of galvanism. It is a white colored metal, resembling sodium, and its equivalent, according to Berzelius, is 6·44; symbol *L*.

What compound does lithium form with oxygen? It forms but one compound, which is 1 eq. of each, and is called *lithia.*

What are the *properties* of lithia? It closely resembles soda and potassa in its chemical relations. Its salts, when heated on a platinum wire before a blowpipe, tinge the flame of a red color.

Ammonium.

What is ammonium? The hypothetical radical, or metal, which is the base of ammonia; equivalent 18; symbol NH^4. *Ammonia* is the protoxide, NH^4O; equivalent 26.

It is gaseous, obtained from the chloride of ammonium by adding quicklime, and applying heat. It has a pungent odor, colorless, alkaline reaction, condensible into a liquid by a pressure of 6·5 atmospheres at 60° F. Water absorbs 700 times its own volume of ammonia, and the solution is called *liquor ammoniæ;* density ·875. It is a powerful alkali, and is arranged with soda and potassa.

OXYSALTS OF AMMONIA.

Carbonate	NH_4O,CO^2	$26+22=48$
Sulphate	NH_4O,SO^3+HO	$26+49=75$
Nitrate	NH_4O,NO^5	$26+54=80$
&c., &c.		

Carbonate, that so called in the shops, is a *sesquicarbonate*, and is prepared by subliming chalk with the chloride of ammonium; the result is sesquicarbonate of ammonia and chloride of calcium. It is converted into the bicarbonate of ammonia ($NH^4O,2CO^2$) by exposure, from the escape of ammonia. The sesquicarbonate is soluble in water, insoluble in alcohol, has the odor of ammonia, an alkaline reaction, and an acrid, hot, alkaline taste.

Sulphate, obtained by adding sulphuric acid to carbonate of ammonia, or to coal-gas liquor, to saturation.

Nitrate, prepared by adding nitric acid to carbonate of ammonia. The protoxide of nitrogen (or laughing gas) is prepared from this.

METALS OF THE ALKALINE EARTHS.

Barium.

How is barium *procured?* By decomposing the carbonate of baryta by means of galvanism, and forming an amalgam with mer-

cury, which amalgam may be decomposed by heat in a vessel free from air. The mercury, being volatilized, leaves the barium in its purity.

What are the *properties* of barium? It is a dark-gray colored metal, attracts oxygen from the air, and yields a white powder, which is baryta, and decomposes water, hydrogen escaping, and baryta is formed. Its equivalent is 68·7; symbol Ba.

What are the *compounds* of barium and oxygen? The protoxide, BaO; and the peroxide, BaO^2.

How is the protoxide of barium, barytes, or baryta, *prepared?* It is produced by the oxidation of barium in air or water, and may be prepared by decomposing the nitrate of baryta at a red heat, or by subjecting the carbonate to an intense white heat with charcoal.

What are the *properties* of *protoxide* of barium? It is a gray powder, sp. gr. 4., difficult to fuse, has caustic alkaline properties, converts vegetable blues to green, and neutralizes acids, has a strong affinity for water, and an intense heat is produced by the union. It is distinguished by its alkaline solution, by all its soluble salts forming white precipitates; the carbonate of baryta, by the addition of alkaline carbonates; and the sulphate of baryta, by the addition of a soluble sulphate or sulphuric acid; and by the characteristics of chloride of barium, formed by the action of the hydrochloric acid on baryta. The carbonate of baryta is soluble in dilute acid, and is poisonous in a soluble state, whether the solution is formed from acid in the stomach or out of it.

How is the *peroxide* of barium *procured?* By passing dry oxygen gas over pure baryta at a low red heat. This oxide is used in forming the peroxide of hydrogen.

What are the *oxysalts* of baryta? They are: —

Carbonate	BaO,CO^2	$76·7 + 22 = 98·7$
Sulphate..........	BaO,SO^2	$76·7 + 40 = 116·7$
Nitrate..............................	BaO,NO^5	$76·7 + 54 = 130·7$

What are the *haloid* salts of barium? They are: —

Chloride	$BaCl$	$68·55 + 35·41 = 103·96$
Bromide..........................	$BaBr$	
Iodide..............................	BaI	

Strontium.

How is strontium *obtained?* By a process analogous to that employed in procuring barium.

What are the *properties* of strontium? It is a heavy metal, similar in properties to barium. Its equivalent is 43·8; symbol Sr.

What are the *oxides* of strontium? They are the protoxide, SrO; and the peroxide, SrO^2.

How is the *protoxide* of strontium, or strontia, prepared? From the nitrate and carbonate of strontia, in the same manner as baryta, which it resembles in most particulars. Its salts are not poisonous; when heated on a platinum fire before a blowpipe, it communicates a red tint to the flame.

How is the *peroxide* procured? In the same way as peroxide of barium, and it is possessed of similar properties.

Calcium.

How is calcium *procured?* Its existence may be shown in the same manner as barium. It is of a whiter color than either barium or strontium, and union with oxygen converts it into lime. Its equivalent is 20; symbol Ca.

How many *compounds* are there of calcium and oxygen? Two; the protoxide, CaO; and the peroxide, CaO^2.

How is the *protoxide* of *calcium, lime,* or *quicklime,* procured? By subjecting carbonate of lime to heat sufficiently strong to expel its carbonic acid.

What are its *properties?* It is a brittle, white, earthy substance, somewhat alkaline, phosphorescent when heated to redness, fusible with great difficulty, slightly soluble in, and has a strong affinity for water, which produces an increase of temperature by the union, and the result is *slaked* lime, which is a *hydrate;* it parts with its water at a red heat.

The most delicate *test* for its presence is oxalate of ammonia or potassa, the oxalate being insoluble. The nitrate yields prismatic crystals, is very deliquescent, and soluble in alcohol, which properties distinguish it from baryta and strontia, the nitrates of which crystallize in octohedrons, and are not deliquescent, or soluble in alcohol.

How is the *peroxide of calcium procured?* In the same way as the peroxide of barium, and possesses similar properties.

What are the *oxysalts* of lime? They are the carbonate, CaO, CO^2; sulphate, CaO^2,SO^3; phosphates polybasic.

Carbonate, found plentifully under the various forms of limestone, marble, &c. In some cases amorphous, and in others crystallized. It is found in solution in waters with an excess of carbonic acid, from which it is often deposited, by parting with this excess, in the form of *stalagmites, stalactites*, &c.

Sulphate may be formed by adding sulphuric acid to the carbonate. It is called *selenite* when occurring native, in a crystalline form.

Plaster of Paris and *gypsum* are sulphate of lime. It contains 2 equivalents of water of crystallization, which it loses when ground up and heated, and becomes an *anhydrous* white powder; it is used for making casts by mixing with water, which enters again into combination with it, becoming a solid hydrate.

Magnesium.

How is magnesium *procured?* By the action of galvanism. It may also be obtained by the action of potassium on the chloride of magnesium.

What are its *properties?* It has a brilliant metallic lustre, a white color, is very malleable, and fuses at a red heat. It burns in oxygen gas when heated to redness, and magnesia is formed. Its equivalent is 12·7; symbol Mg.

What *compound* does magnesium form with oxygen? The protoxide, MgO, known as magnesia. It may be procured by exposing the carbonate of magnesia to a high red heat; and is called *calcined magnesia.*

What are the *properties* of magnesia? It has feeble alkaline properties, except in forming neutral salts with acids. Its sulphate is very soluble, which serves to distinguish it from the other alkaline earths. It is precipitated from its salts as a hydrate by pure alkalies, and may be distinguished and separated from lime by the oxalate of ammonia.

It forms several *salts* with acids.

Carbonate, the *magnesia alba* of the shops, may be prepared by adding carbonate of potassa to sulphate of magnesia, by which

process it is precipitated as a fine white powder. Its formula is MgO,CO^2; equivalent 42·67.

Sulphate, $MgOSO^3 + 7HO$; equivalent 123·67.

Epsom salts, found in some mineral springs, and in sea water; very soluble; crystals are four-sided pyramids It is the type of a large class of metallic salts, $MgO,SO^3, HO + 6HO$. The one equivalent of water is constitutional, which, if separated, destroys the salt, unless its place is supplied by another salt. This may be done as in sulphate of magnesia and potash, $MgO,SO^3(KO,SO^3) + 6HO$.

The best *test* is to form the ammonia-magnesium phosphate by the addition of ammonia to a soluble phosphate of magnesia. It also forms, by the addition of sulphuric acid, the Epsom salt, having its characteristic bitterness.

Metals of the Earths Proper.

Aluminum.

How is aluminum procured? By the decomposition of the chloride of aluminum by potassium. The changes are as follows: $Al^2Cl^3 + 3K = 3KCl + 2Al$.

What are the *properties* of aluminum? It is a gray powder, resembling platinum, or in small scales or spangles of a metallic lustre; a conductor of electricity when fused, but not in powder, and fusible at a temperature above the fusing point of cast iron. Burns in the open air when heated to redness, and forms a white aluminous earth. Its equivalent is 13·7; symbol Al.

What is the composition of *alumina*, or *aluminous earth*? It is a *sesquioxide of aluminum*

How is alumina *procured*? By dissolving purified alum, adding an excess of carbonate of potassa, the alumina is precipitated, and may be collected on a filter.

What are the *properties* of alumina? It is tasteless, inodorous, insoluble in water, very infusible, and has a powerful affinity for water.

It may be distinguished by being separated from the acids as a *hydrate*, by the alkaline carbonates and ammonia; by being precipitated by pure soda, or potassa, and the precipitate redissolved by an excess of the alkali.

Sulphate, $Al^2O^3,3SO^3$; eq. 171·38. It is decomposed in solution by all the alkalies; it will unite with other salts, and thereby form double ones.

Sulphate of alumina and *potassa*, $Al^2O^3,3SO^3 + KO,SO^3 + 24HO$, eq. 474·57. This is the *common alum*, which is procured from a clay containing sulphuret of iron. The sulphur forms sulphuric acid, unites with the alumina and iron, and the iron may be displaced by adding chloride of potassium; the result then will be sulphate of alumina and potassa, and the chloride of iron. Crystals are octohedrons, and their water is easily expelled by heat.

Sulphate of alumina and *soda*, $Al^2O^3 3SO^3 + NaO,SO^3 + 24HO$.

Sulphate of alumina and *ammonia*, $Al^2O^3 3SO^3 + NH^4O,SO^3 + 24HO$.

These are analogous to common alum, and are formed in the same way.

The other metals of the earths are *Glucinum*, *Yttrium*, *Thorinum*, and *Zirconium*. They are unimportant.

Metals which decompose Water at a Red Heat.

Manganese, or Manganesium.

How is manganese *procured?* It is procured from the oxide, by heating it in contact with oil and charcoal.

What are the *properties* of manganese? It is of grayish-white color, granular texture, difficult of fusion, tarnishes by exposure to the air, and burns if heated to redness in open vessels. Its equivalent is 27·7; symbol Mn; specific gravity 8.

What are the *compounds* of manganese and oxygen? The protoxide, MnO; the sesquioxide, Mn^2O^3; the binoxide, MnO^2; manganic acid, MnO^3; permanganic acid, Mn^2O^7; red oxide of manganese, Mn^3O^4; and varvacite, Mn^4O^7.

How is the *protoxide* of *manganese* procured? By exposing the peroxide, sesquioxide, or red oxide of manganese to charcoal and heat combined, or to heat and a current of hydrogen.

What are the *properties* of the protoxide of manganese? It is of a light green color, attracts oxygen from the air, and unites readily with acids.

How is the *sesquioxide* of *manganese* procured? It is found in nature, and may be formed by exposing the peroxide for some time to a moderate red heat.

How is the *binoxide, peroxide*, or *black oxide* of manganese procured? It is found in nature mixed with siliceous, or aluminous earths, oxide of iron: and carbonate of lime. It may also be formed artificially, by subjecting the nitrate of the protoxide of manganese to a low red heat until the nitric acid is expelled.

What are its *properties*? It is unchangeable by exposure to the air, insoluble in water, does not unite with acids or alkalies, and yields oxygen gas when boiled with sulphuric acid; or, if hydrochloric acid is used, chlorine is evolved.

It is much used in the arts for manufacturing glass, and in preparing chlorine for bleaching purposes.

How is the *red oxide* procured? It is found in nature, and may be artificially formed by exposing the peroxide or sesquioxide to a white heat. Of the same degree of fineness it is brownish-red when cold, and black when warm.

How is the *varvacite* procured? It is only procured as a natural production among some of the ores of manganese.

What are the *tests* for manganese. If fused with borax by the blowpipe, a bead of an amethyst color is formed; the peculiar chameleon properties of manganic acid are the best test. Ammonia throws down a precipitate which becomes flesh colored, and is insoluble in excess of precipitant.

Iron.

How is iron generally *found* in *nature*? In large quantities in combination with oxygen and sulphur, called *ores* of iron; but it is diffused almost universally in greater or smaller quantities.

How is iron *procured*? By subjecting the ores, roasted and reduced to coarse powder, to the action of charcoal, or coke, and lime at a high heat.

What is the *rationale* of this proccss? The carbon deprives the ore of its oxygen, and the lime acts as a flux by combining with the impurities, and forms a compound fusible mass, called slag, which allows the melted particles of iron to descend through it, and collect at the bottom. If the iron is in the condition of a sili-

cate, the following occurs: $FeOSiO^3 + CaO + C = CaOSiO^3 + Fe + CO$.

What are the *properties* of iron? It has a gray color, strong metallic lustre, susceptible of polish, is ductile, malleable, and very tenacious. It is attracted by the magnet, and may be rendered magnetic, a property possessed by no other metal except nickel. It has a strong affinity for oxygen, but does not take it from a dry atmosphere; but, if moisture be present, it *oxidizes* or *rusts;* if heated to redness in the open air, it absorbs oxygen rapidly, and is converted into black scales, which are the black oxide of iron; and if in oxygen, it is attended with vivid scintillations. Its equivalent is 28; symbol Fe; sp. gr. 7·788.

What are the *compounds* of *iron* and *oxygen?* The protoxide, FeO; the red, per, or sesquioxide, Fe^2O^3; the black oxide, Fe^3O^4; and ferric acid, FeO^3.

Where is the *protoxide* of iron found, and what are its *properties?* It is the base of the native carbonate of iron. It is formed when metallic iron is placed in dilute sulphuric acid; and is precipitated as a *white hydrate,* from its salts, by pure alkalies. Its salts, when in solution, absorb oxygen from the air. A solution of galls does not produce a change of color, but alkaline hydrosulphates cause a black precipitate, the protosulphuret of iron.

How is the *red,* or *sesquioxide,* of iron *procured?* It is a natural product, known as red hæmatite, and is found massive, fibrous, and in rhomboidal crystals. It may be formed by dissolving iron in nitro-hydrochloric acid, and precipitating with an alkali. In this state it is a hydrate.

What are the *properties* of the red, or sesquioxide? It combines with most of the acids, forming salts, which are generally red; and it may be precipitated from them by pure alkalies as a *hydrate. Prussian blue* is formed by the addition of ferrocyanuret of potassium to this oxide, and a blood-red color is produced by sulphocyanuret of potassium, and a black color by the infusion of galls. These last reagents may be considered as unerring *tests* for the minutest quantity of the sesquioxide, and any other oxide may be converted into this by nitric acid. It is not attracted by the magnet.

Where is the *black,* or *magnetic oxide* of iron found, and what is its composition? It is found native, often crystallized in regu

lar octohedron and dodecahedron form; it is attracted by the magnet, and may become magnetic. It is also formed when iron is heated to redness in the open air, or in contact with aqueous vapor. It is composed of the protoxide, and the red or sesquioxide combined.

What are the *oxysalts* of iron? The *sulphate of protoxide*, $FeO,SO^3HO + 6HO$; commonly called *copperas*, or *green vitriol*. May be formed by the action of sulphuric acid and water on iron; but, for commercial purposes, by exposing iron pyrites (the sulphuret) to air and moisture. It effloresces by exposure, and the sesquioxide is formed on its surface.

Sesqui, or *Persulphate*, $Fe^2O^3,3SO^3$, may be obtained by adding sulphuric acid to the sesquioxide; an alkali or an alkaline carbonate added to its solution, precipitates the sesquioxide, because carbonic acid cannot unite with it.

Nitrate of Protoxide, FeO,NO^5, may be obtained by dilute nitric acid and iron.

Per, or *Sesquinitrate*, $Fe^2O^3, 3NO^5$; formed by adding an excess of nitric acid.

Carbonate of Protoxide, $FeO,CO^2 + HO$, may be formed by adding a solution of carbonate of soda to a solution of the protosulphate of iron, from which its precipitated. It absorbs oxygen, is converted into sesquioxide, and carbonic acid is liberated, because it will not form a union with the per or sesquioxide. This increase of oxidation may be prevented by incorporating it as soon as formed with honey or sugar.

What are the *haloid salts* of iron? *Protochloride*, $FeCl$; may be formed by dissolving iron in chlorohydric acid, and by putting iron in a state of minute division into chlorine gas.

Sesquichloride, Fe^2Cl^3, may be formed by adding two parts of chlorohydric acid and one of nitric, to metallic iron.

Protoiodide, FeI; formed by heating an excess of iron in a solution of iodine, and preserved by sugar, or iron clippings. It is esteemed as a remedial agent very highly by many.

Sesquiodide, Fe^2I^3.

What are the *compounds* of sulphur and iron? The tetrasulphuret, Fe^3S; the disulphuret, Fe^2S; the protosulphuret, FeS; the sesquisulphuret, Fe^2S^3; the bisulphuret, FeS^2; and the magnetic

pyrites, Fe^2S^3; which is a compound of the bisulphuret and the protosulphuret.

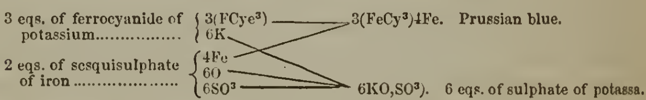
It is found in nature in combination, called *iron pyrites*, which is chemically the bisulphuret, called also fool's gold, from its hard, shining, yellow appearance.

Protosulphuret, FeS; obtained by burning red-hot iron in contact with sulphur. It is magnetic, and of a dark color.

Ferrocyanide of Potassium. Yellow Prussiate of Potash, Fe,Cy^3 2K, or $Fe(C^6N^3)$, 2K.

It is manufactured on a large scale by placing carbonate of potassa and iron in contact with animal matter, as old leather, bones, hair, &c., and subjecting them to a high heat. The cyanide of potassium is first formed, which forms a union with the iron — the ferrocyanide of potassium. This salt may then be dissolved out and crystallized in beautiful, large, yellow, octohedral crystals.

Ferrocyanide of iron; Prussian blue, $3(FeCy^3)4Fe$ or Fe_3Cy^9,F, prepared by adding ferrocyanide of potassium in solution to a sesquisalt of iron, for instance, the sesquisulphate.



What are the *compounds* of carbon and iron? There are three distinct compounds; graphite, cast, or pig iron, and steel.

Where is *graphite* (called also *plumbago* and *black lead*) obtained? It is found as a natural production, and may be formed artificially by exposing iron with an excess of charcoal to a violent and long-continued heat. It contains about five per cent of iron when pure.

Zinc.

How is zinc *found* in nature, and how is it *procured*? It is found native as a *carbonate*, called *calamine*, and as a *sulphuret*, called *zinc-blende*. It is procured by exposure to heat and carbon from the calamine, and from the blende by the same process, after roasting or exposure to air at a low red heat. The metal is distilled by a process termed distillation by descent, and may be purified by being again distilled.

What are the *properties* of zinc? It has a metallic lustre, bluish-white color, a laminated texture, is hard and brittle, and, by exposure in close vessels to a white heat, it is sublimed unchanged. It absorbs oxygen, and forms the white oxide or flowers of zinc, if heated to fusion in open vessels, or, if heated to redness in a closed vessel, and the cover removed, combustion takes place with a white light. Its equivalent is 32·3; sp. gr. 7; symbol Zn.

What are the *compounds* of *zinc* and *oxygen?* There are two, the protoxide, ZnO; and the peroxide, the composition of which is uncertain.

How is the *protoxide* of zinc *procured?* By the addition of dilute sulphuric acid to zinc, and by collecting the flakes which arise during the combustion of zinc.

What are the *properties* of the protoxide of zinc? It is insoluble in water, forms regular salts with acids, and combines with some of the alkalies. It is precipitated from its solutions as a white hydrate by pure potassa or ammonia; as a carbonate, by the carbonate of ammonia; and is redissolved by the addition of an excess of the precipitant. Alkaline carbonates precipitate as a white carbonate, and hydrosulphate of ammonia precipitates it as hydrated sulphuret.

Sulphate, ZnO,SO^3, $HO+6HO$; this is *white vitriol*, and may be prepared by adding sulphuric acid to zinc, water being present.

Carbonate, $ZnO, CO^2 + HO$, may be prepared by adding the carbonate of an alkali to a solution of the sulphate, and it will be precipitated. It is found native as *calamine*.

Chloride, ZnCl, may be formed by burning zinc filings in chlorine gas, or dissolving zinc in chlorohydric acid.

Tin.

How is tin generally *found* in nature, and how is it *procured?* It occurs native as an *oxide;* from which it may be procured by heat and charcoal.

What are the *properties* of tin? It resembles silver in its appearance; its brilliancy is lost slowly by contact with the atmosphere; it is malleable, inferior in ductility and tenacity, soft, inelastic, and, when bent backwards and forwards, produces a peculiar crackling noise. Its equivalent is 58·9; sp. gr. 7·291; symbol Sn.

What are the *compounds* of *tin* and *oxygen?* The protoxide, SnO; the sesquioxide, Sn^2O^3; and the binoxide, SnO^2.

What is the *purple* of *Cassius?* It is a combination of the binoxide of tin and protoxide of gold, produced by the action of the protoxide of tin on a solution of gold. This property of forming a purple precipitate with a solution of gold is considered as a *test* for the protoxide of tin.

What is understood by *stannates?* They are combinations of binoxide of tin, which possesses feeble acid properties, with the alkalies.

What is the composition of the *fuming liquor of Libavius?* It is the *bichloride of tin*, and the dense white fumes emitted when it is exposed to the air are caused by its union with moisture.

Tin has two *chlorides* and two *sulphurets.*

Cobalt.

How is cobalt *found* in nature? It is generally found in combination with arsenic. Its equivalent is 29·5; sp. gr. 7·834; symbol Co.

What are the compounds of oxygen and cobalt? The protoxide, CoO; the sesquioxide, Co^2O^3; and the complex oxide, Co^3O^4.

The *tests* for cobalt are, that its salts are generally red; the precipitate of the protoxide by an alkali is always blue; *smaltz* is a silicate. The chloride is red in solution, but becomes blue by drying.

Nickel.

How is nickel *found* in nature? Generally as a copper-colored mineral, which is the *arseniuret of nickel*, containing small portions of sulphur, copper, cobalt, and iron, and called *kupfernickel* by the miners. The process for procuring it is somewhat complicated.

What are the *properties* of nickel? It is whitish, intermediate between tin and silver, has a strong metallic lustre, and is ductile and malleable. It is attracted by the magnet, and may be rendered magnetic, but its oxides are not. Its equivalent is 29·5; sp. gr. 8·279; Symbol Ni.

The salts of nickel are generally green; the protoxide is precipitated from any of its salts in solution by an alkali, as a beautiful green hydrate, and sulphuretted hydrogen gives a black sulphuret.

Metals which do not decompose Water at any Temperature, and the Oxides of which are not reducible to the Metallic State by heat alone

Arsenic.

How is arsenic *found* in nature? Sometimes native, but generally in combination with other metals.

How is it *procured?* By roasting the ores, it is volatilized, combines with oxygen, and is condensed in cakes, which are the white oxide. From this the metal may be procured by heat and charcoal, the pure metal being sublimed, and may be collected in a proper vessel.

What are the *properties* of arsenic? It is brittle, has a metallic lustre, a whitish-gray color, and crystalline. Its equivalent is 75; sp. gr. 5·8843; symbol As.

What are the *compounds* of arsenic and oxygen? There are two; the arsenious acid, AsO^3, and the arsenic acid, AsO^5.

How is *arsenious* acid *prepared?* It is generated when arsenic is heated in open vessels, and it may be prepared by digesting it with dilute nitric acid, or the white arsenic of commerce (generated by roasting the ores of arsenic and cobalt); may be purified by a second sublimation.

What are the *properties* of arsenious acid? It is mostly sold in the state of fine white powder, but when first sublimed it is in brittle masses of a vitreous lustre. It is sublimed at 380°, and may be condensed on cold surfaces. It is susceptible of two different crystalline forms, and is, therefore, termed dimorphous. It reddens vegetable blue colors feebly, combines with salifiable bases, forming salts, termed arsenites, and is a virulent poison.

What are the important *tests* for arsenious acid? The ammoniacal nitrate of silver, ammoniacal sulphate of copper, hydrosulphuric acid, hydrogen gas, and the metallic copper test of Reinsch.

The *first* of these produces a *yellow precipitate*, the arsenite of oxide of silver. This test is liable to some objection when sea salt or animal and vegetable infusions are present, from the arsenite of

silver not subsiding at all, or in such an impure state that it cannot be recognised properly.

The *second*, the *ammoniacal sulphate of copper*, produces a *green precipitate*, known as *Scheele's green;* yet there are circumstances under which a greenish precipitate may be formed with ammoniacal sulphate of copper, that may be mistaken for Scheele's green where no arsenic is present, and under other circumstances it may be present in minute quantity, and no precipitate be formed. It may, therefore, be considered a fallacious test when applied to mixed fluids, however sure it may be when the arsenious acid is dissolved in pure water.

The *third*, the *hydrosulphuric* acid, produces a *yellow precipitate* in the liquid when this gas is passed through it, from the formation of *orpiment*, or the sesquisulphuret of arsenic. When this test is used, the liquid should not contain a free alkali; and, to avoid it, a little acetic acid should be added. Thus far this test may be considered fallacious, as the same colored precipitate may be produced with selenium, cadmium, tin, and antimony. But the precipitate, the *sesquisulphuret of arsenic*, formed by this process, may be distinguished from all other substances by being dried, mixed with black flux, and heated in a glass tube to redness; decomposition takes place, and the metallic arsenic is deposited of an iron-gray color externally, and crystalline internally, on the cool part of the tube. Additional evidence may be had by converting the metal into arsenious acid, which may be done by holding that part of the tube in which the metal is deposited over a spirit-lamp in such a manner that the metal may be sublimed slowly, and as it is vaporized it combines with oxygen, and is deposited in another portion of the tube in beautiful octohedral crystals, that may easily be detected by a practised eye. In this experiment the tube should be clean and dry.

The *fourth*, the application of *hydrogen*. An arseniuretted hydrogen is formed, which is a gaseous compound that yields metallic arsenic or arsenious acid, and water in combustion; the metallic arsenic or arsenious acid being deposited accordingly as the supply of oxygen is more or less abundant, each with its peculiarities.

The apparatus for conducting this process is called Marsh's.

The arseniuretted hydrogen is prepared by adding a fluid con-

taining arsenic to the ordinary apparatus for generating hydrogen. So that, if a suspected fluid contain arsenic, and is added in this way, we will have this product.

The *metallic copper* test consists in boiling clean strips of copper in the liquid supposed to contain arsenic, which should previously be acidulated slightly with acetic or hydrochloric acid. If arsenic be present, it will be precipitated on the bright surface of the copper, and present the lustre of metallic arsenic. This precipitate may be further tested by the various processes for testing arsenic.

A good plan to pursue is the following, viz: Boil clean strips of copper foil in dilute muriatic acid, for the purpose of testing the freedom of the materials from arsenic; then add the suspected fluid, and continue the boiling; if arsenic be present, the copper will soon be coated over, presenting the appearance of rolled zinc. Take the copper and deposit; introduce them into a subliming tube of French glass, closed at the lower end; apply a spirit lamp until the copper becomes bright, when a steel-colored crust will be formed on the cooler portion of the tube. Then open the lower end of the tube, so as to admit air freely, and apply heat again, so as to resublime the crust, which will be deposited in the form of a white ring, instead of a metallic one, in consequence of having become oxidized, or changed back to arsenious acid. Take the subliming tube and contents, and boil in distilled water; test the solution with sulphate of copper and nitrate of silver, and expose to the vapor of ammonia, which will give the characteristic reactions.

We have here a series of processes having the advantage of *accuracy*, *delicacy*, and *simplicity*, and combining all the best tests. No special apparatus is necessary, and the whole may be gone through with in a short space of time. This is the plan pursued by Dr. Raymond, as a modification of Reinsch's method.

The best *antidote* is the hydrated peroxide of iron.

What are the *compounds* of sulphur and arsenic? There are three. The *bisulpuret* or *realgar*, is found in the mineral kingdom, and may be formed artificially by heating arsenious acid with about half its weight of sulphur until it fuses. Its equivalent is 107.

The *tersulphuret*, or *orpiment*, is also found in nature, and may be prepared by fusing together equal parts of arsenious acid and

sulphur. This is the coloring principle of the paint called *King's yellow.*

The *persulphuret,* which may be prepared by passing hydrosulphuric acid gas through a solution of arsenic acid. It resembles orpiment in color.

Antimony.

How is antimony *found* in nature? It is generally found as a sulphuret, and called crude antimony; although it sometimes occurs native.

How is it *procured?* By heating the sulphuret in a covered crucible with half its weight of iron filings, or by mixing with it two-thirds its weight of cream of tartar, and one-third nitre; and throwing the mixture in small portions successively into a red-hot crucible.

What are the *properties* of antimony? It is brittle, white, running into bluish gray, has considerable metallic lustre, fuses at 810°, and is volatilized at a very high temperature. Its equivalent is 129·04: sp. gr. 6·702; symbol Sb.

What are the compounds of antimony? They are:—

Teroxide	SbO^3	$129{\cdot}04 + 24 = 153{\cdot}04$
Antimonious acid	SbO^4	$129{\cdot}04 + 32 = 161{\cdot}04$
Antimonic acid	SbO^5	$129{\cdot}04 + 40 = 169{\cdot}04$
Terchloride	$SbCl^3$	
Pentachloride	$SbCl^5$	
Tersulphuret	SbS^3	
Sulphantimonious acid	SbS^4	
Pentasulphuret, or sulphantimonic acid	SbS^5	
Tartrate of antimony and potassa	$SbO^3,KO,C^8H^{10}O^4 + 2HO.$	

How is the *teroxide* of antimony procured? By sublimation during the combustion of antimony; and by adding carbonate of potassa, or soda, to a solution of tartar emetic.

What are the *properties* of the teroxide of antimony? It is a white powder of a somewhat dirty appearance; when heated, it acquires a yellow tint, and, if protected from the atmosphere, it may be sublimed without change. Heated in contact with the air, it absorbs oxygen, and, if heated suddenly, it takes fire and burns; in both cases antimonious acid is generated. It is the only combination of oxygen and antimony which forms salts with acids, and

is the base of *tartar emetic*, or the *tartrate of antimony and potassa*. Its salts are insoluble in, or decomposed by water, except tartar emetic. The insoluble salts of antimony are rendered soluble by excess of tartaric or hydrochloric acids. The presence of antimony in solution may easily be detected by hydrosulphuric acid, which produces an orange-colored precipitate, *hydrated tersulphuret of antimony*, called *Kermes mineral*.

Tartrate of antimony and potassa, $SbO^3,KO,C^8H^{10}O^4 + 2HO$, or *tartar emetic*, may be prepared by boiling the teroxide of antimony with cream of tartar.

It is a bibasic salt; in cream of tartar, we have the tartaric acid united to two bases (potassa and water); when the teroxide is boiled with it, it takes the place of the water, and this salt is formed.

Copper.

How is copper *found* in nature? It is often found native, but generally in combination with sulphur, as the native sulphuret, which is sometimes combined with sulphuret of iron.

What are the *properties* of copper? It is of a red color, which distinguishes it from all other metals, except titanium; it is ductile, malleable, tenacious, hard, elastic, and sonorous. It does not change in a dry atmosphere, but rusts in a damp one, and is converted into a green carbonate of the black oxide of copper. Its equivalent is 31·6; sp. gr. 8·895; symbol Cu.

What are the *compounds* of copper and oxygen? The dinoxide, Cu^2O, the black or protoxide, CuO; and the peroxide, CuO^2.

Which of these oxides unites with acids and forms salts? The *protoxide*.

What are the *oxysalts* of copper?

Nitrate	$CuONO^5 + 3HO$
Sulphate	$CuOSO^3 + 5HO$
Carbonates.	

What is *blue vitriol?* It is the *sulphate of copper*, formed by boiling sulphuric acid upon copper, $Cu,SO^3 + 5HO$.

The crystals contain five equivalents of water, isomorphous with sulph. magnesia. It contains one equivalent of constitutional water, which may be replaced with another salt, forming a double

one. The addition of ammonia to this salt in solution produces a precipitate of the protoxide, which, on continuing to add the ammonia, is redissolved, and ammoniated copper is formed, or a double salt, the sulphate of ammonia and copper, of a deep-blue color.

Sulphate of copper may be rendered anhydrous by heat, and be comes nearly white, and is decomposed at a high temperature.

How are the *salts* of copper *distinguished?* They have a green or blue tint; hydrosulphuric acid precipitates a dark brown sulphuret, and ferrocyanuret of potassium precipitates a reddish-brown ferrocyanuret; and it is precipitated in the metallic state by a rod of iron or zinc.

What is *crude verdigris?* It is a mixture of *neutral acetate* or *subacetate of copper* with impurities.

What are the *crystals of Venus?* It is a crystallized *neutral acetate.*

Lead.

How is lead *found* in nature? As a sulphuret, the *galena* of mineralogists; as an oxide; and as a salt.

How is it *procured?* By roasting galena at a moderate temperature, by which it is converted into the sulphate of lead, which is then intimately mixed with another portion of the ore, and the temperature rapidly increased, by which sulphurous acid and metallic lead are formed, thus: $PbOSO^3 + PbS = 2SO^2 + 2Pb$.

What are the *properties* of lead? It has a bluish-gray color, a strong metallic lustre, tarnishes by exposure to the air, and acquires a thin coat of the carbonate of the protoxide. It fuses at 612°, and is ductile in large masses. Its equivalent is 103·6; sp. gr. 11·352; symbol Pb.

What are the *compounds* of lead and oxygen? They are:—

Suboxide	Pb^2O	207·12 + 8 = 215·12
Oxide	PbO	103·56 + 8 = 111·56
Binoxide	PbO^2	103·56 + 16 = 119·56
Minium, or red lead	2PbO, PbO_2, or Pb_3O_4.	

What are the *characteristics* of the *dinoxide,* or *suboxide?* It is generally known as *dross;* it is of a dark-gray color, and is unimportant in its chemical relations.

How is the *protoxide procured?* By collecting the gray film which forms on the surface of melted lead, and exposing it to heat and air until it becomes yellow.

In the state of powder, it is called *massicot;* but, when partially fused, by which it is *vitrified,* it is called *litharge*, and contains a slight mixture of red oxide.

What are its *properties?* It has a lemon-yellow color; it is insoluble in water, fused at a bright red heat, and unchangeable in the fire, but may be reduced by heat and combustible matters. It is the base of all the salts of lead, and these are generally of a white color. It acts in some cases as an acid, by uniting with alkalies.

Red lead, or *minium*, $2PbO,PbO^2$, is formed by passing air over massicot without fusing, but at a considerable heat. It is a mixture of the bi and protoxide.

What are the *properties* of the *red oxide?* It does not unite with acids, gives off oxygen when heated to redness, and is converted into the protoxide; it is resolved into protoxide and peroxide by nitric acid.

What are the *oxysalts* of lead?

Nitrate	PbO,NO^5
Sulphate	PbO,SO^3
Carbonate	PbO,CO^2
Chromate	PbO,CrO^3
Acetate	$PbO,C^4H^3O^3 + 3HO$
Tribasic acetate	$3PbO,C^4H^3O^3 + HO$
&c. &c.	

Nitrate of Lead, PbO,NO^5, may be obtained by adding nitric acid to metallic lead. It is soluble, and crystallizes in opaque anhydrous octahedrons.

Acetate of Lead, $PbO,C^4H^3O^3 + 3HO$, may be prepared by boiling litharge in acetic acid. It may be crystallized, and contains 3 equivalents of water. It is known as *sugar of lead*, and is very soluble in water and alcohol. Its taste is sweet and astringent, and in large doses it is poisonous.

The *Subacetate*, $3PbO,C^4H^3O^3 + HO$; prepared by boiling the acetate with litharge; called, also, *Goulard's extract.*

Which salt of lead is the most poisonous? The *carbonate ceruse*, or *white lead*, so that any salt of lead, as the acetate,

which is easily changed into the carbonate, may also be poisonous by conversion into the carbonate in the stomach. This may be obviated by administering an excess of vinegar, or acetic acid, with the acetate.

What are the *tests* for lead? The hydrosulphuric acid, which gives a black precipitate. The sulphates give a white precipitate with lead, that is insoluble in nitric acid. Hydriodate and chromate of potash give yellow precipitates, the iodide and chromate of lead. It is also separated from its salts in the metallic form by iron or zinc. The lead is deposited, forming the arbor Saturni.

How is *peroxide* of lead *procured?* By the action of nitric acid on minium, which dissolves the protoxide and leaves the peroxide; and by passing a current of chlorine through a solution of acetate of lead. This oxide is of a pure brown color, insoluble in water, does not unite with acids, and is resolved into a salt of the protoxide and oxygen gas by strong ox-acids.

What are the *haloid salts* of lead? Chloride, PbCl; bromide, PbBr; iodide, PbI.

Bismuth.

How is it *found* in nature? In combination with sulphur, arsenic, iron, and copper. Equivalent 70·95; sp. gr. 9·90; symbol Bi; and melts a 497°.

May be *obtained* pure by heating the nitrate.

What are its *properties?* Beautifully crystalline, a steel-like lustre, undergoes little change by exposure, and, when heated in the open air to 500°, takes fire and burns with a bluish-white flame, and copious fumes are emitted, which is the protoxide of bismuth; and nitric acid is its proper solvent. *Rose's fusible metal* is composed of 8 parts of bismuth, 5 of lead, and 3 of tin; and melts at 212° F.

What are the *compounds* of bismuth? They are:—

Suboxide	Bi^2O	$141{\cdot}90 + 8 = 149{\cdot}90$
Protoxide	BiO	$70{\cdot}95 + 8 = 78{\cdot}95$
Chloride	$BiCl$	$70{\cdot}94 + 35{\cdot}41 = 106{\cdot}35$
Nitrate	$BiO,NO^5 + 3HO$	
Subnitrate	$3BiO,NO^5 + HO$	

The *protoxide*, BiO, is the base of the oxysalts.

Chloride, $BiCl$; procured by introducing bismuth in powder in chlorine gas; it was formerly called the *butter of bismuth.*

Nitrate of Bismuth, $BiO,NO^5 + 3HO$; prepared by adding nitric acid to bismuth. It forms transparent colorless crystals, which, when thrown into water, are decomposed, and converted into a *supernitrate*, which remains in solution; and a *subnitrate*, which is precipitated, and is sometimes called *magistery of bismuth*, $3BiO,No^5 + HO$.

What are the *tests* for bismuth? By the addition of water to the protosalts the subsalts are precipitated; and sulphuretted hydrogen produces an intense brown precipitate from the salts of this metal.

Metals, the Oxides of which are reduced to the Metallic State by a red heat.

Mercury, or Quicksilver.

How is mercury *found* in nature? It is found native, combined with sulphur, as *cinnabar*, which is its most abundant form; amalgamated with silver; and as a chloride.

How is it *procured*, and from where? By heating the sulphuret with lime, or iron filings, by which means the mercury is volatilized and the sulphur retained. To purify it, it may be digested with sulphuric acid. It is brought principally from Spain, Hungary, Asia, and South America.

What are its *properties*? It is fluid at common temperatures, of a tin-white color, and has a strong metallic lustre. It freezes at 39° or 40° below zero; boils at about 662°, and does not tarnish by exposure to the air if perfectly pure. It is acted upon by nitric and hot sulphuric acids. Its equivalent is 101; sp. gr. (fluid) 13·568, (frozen) 15·612; symbol Hg.

What are the *compounds* of mercury and oxygen? There are two, the suboxide, Hg^2O; and the protoxide, HgO.

How is the *suboxide* of mercury *procured*? By mixing calomel briskly with an excess of potassa, the oxygen and chlorine exchange places, and chloride of potassium and the suboxide of mercury are formed. It may also be procured by adding an alkaline solution to the nitrate of the suboxide of mercury.

What are the *properties* of the suboxide of mercury? It is a

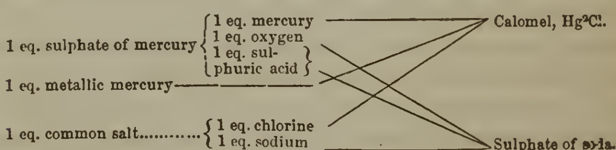
black powder, easily decomposed, unites with acids, but is a weak base. The nitrate is decomposed by alkalies, which throw down the suboxide; by alkaline carbonates throwing down the white carbonate; by hydrochloric acid, or any soluble chloride, and the subchloride, or calomel is formed; and by hydrosulphuric acid, and the black protosulphuret is produced.

How is the *protoxide* procured? By the action of heat and air combined; by dissolving mercury in nitric acid; and by exposing the nitrate to a heat sufficient to expel the nitric acid. It is the *red precipitate* of popular language.

What are the *properties* of the protoxide? It is in shining crystalline scales, when hot it is nearly black, and red when cold, finely powdered it is of an orange color; when heated to redness it is resolved into metallic mercury and oxygen. It is separated from acids by ammonia and its carbonate, as a white precipitate.

What are the *compounds* of chlorine and mercury? They are the subchloride or calomel, which is 2 eqs. of mercury, and 1 eq. of chlorine; and the chloride, or corrosive sublimate, which is 1 eq. of mercury, and 1 eq. of chlorine.

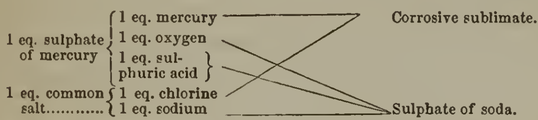
How is the *subchloride*, or *calomel*, Hg^2Cl, procured? It is generated when mercury and chlorine come in contact at common temperatures; by the union of mercury and the chloride, which should be sublimed; and by mixing the nitrate of the suboxide with hydrochloric acid, or a soluble chloride. It is usually procured by rubbing the dry sulphate of the red or protoxide with as much metallic mercury as is contained in the sulphate, and a quantity of common salt, until the globules disappear and the mixture becomes uniform. Subject this to sublimation; carry the vapor of calomel into an atmosphere of steam, in which it becomes condensed in a state of minute division.



What are its *properties*? It is white, crystalline, compact, tasteless, inodorous, and not altered by exposure to the atmosphere if light is excluded; but by this it is rendered black and partially

reduced to the metallic state; alkaline solutions render it black by the formation of the suboxide. It sometimes contains portions of the chloride, which would be a dangerous combination when employed in medicine; and may be detected by boiling with water, and adding caustic potash to the filtered liquid, which will give a yellow precipitate if corrosive sublimate be present.

How is the *chloride*, or *corrosive sublimate* procured? By heating mercury in chlorine gas, and by subliming a mixture of 1 eq. of the sulphate of the red oxide of mercury with 1 eq. of the chloride of sodium. The products of this last process are 1 eq. of the chloride of mercury, and 1 eq. of the sulphate of soda. The action may be explained as follows: —



What are its *properties*? It is white, semitransparent, crystalline, and poisonous; has an acid, burning taste, and leaves a nauseous metallic one. It is slightly soluble in cold water, and highly soluble in hot water and alcohol. By the addition of ammonia to its solution, the *white precipitate* is formed.

What are the *tests* for corrosive sublimate? Hydrosulphuric acid precipitates the black sulphuret of mercury; lime-water and the pure fixed alkalies a yellow peroxide of mercury; hydriodate of potassa precipitates the iodide of mercury, which is of a scarlet color, and resembles no other iodide; protochloride of tin causes a black precipitate with the salts of mercury, which is perhaps the most delicate test we possess for them. Another is to place a drop of the suspected liquid on polished gold, and touch it through the liquid with a piece of iron wire or point of a knife, when the part touched instantly becomes white, which is caused by an amalgam of gold. Albumen or white of eggs produces a white flocculent precipitate, which is a compound of calomel and albumen, and is inert; therefore, white of eggs is an *antidote* for poisoning by corrosive sublimate.

What are the *iodides* of mercury? They are the *subiodide*, which is mercury 2 eqs. and iodine 1 eq., Hg I; and is obtained

by mixing the nitrate of the suboxide of mercury with the iodide of potassium. It is a greenish-yellow powder, insoluble in water.

The iodide, which is 1 eq. of mercury and 1 eq. of iodine, HgI; and is obtained by adding the iodide of potassium in solution to the nitrate of the protoxide; or to the chloride of mercury. It is precipitated as a rich red-colored powder, vieing in beauty with vermilion.

What are the *compounds* of mercury and sulphur? The *subsulphuret*, which is 2 eqs. of mercury to 1 eq. of sulphur, Hg^2S; and may be formed by passing hydrosulphuric acid gas through a solution of the nitrate of the suboxide of mercury, or through water with calomel suspended in it.

The *sulphuret*, which is 1 eq. of mercury to 1 eq. of sulphur, HgS; and is formed by fusing sulphur with six times its weight of mercury, and subliming in close vessels. This is *fictitious cinnabar*, and, when powdered, it forms the beautiful pigment *vermilion*.

What is *ethiops mineral?* It is a mixture of sulphur and the sulphuret of mercury, and is formed by triturating together equal parts of mercury and sulphur. It is the subsulphuret, Hg^2S.

What compound does mercury form with cyanogen? A cyanide, $HgCy$, obtained by heating the red oxide of mercury with Prussian blue.

The *salts* of mercury are all volatilized or decomposed by a temperature of ignition; those that do not yield the metal by simply heating, may be caused to do so by the addition of dry carbonate of soda. The metal is displaced from its soluble combinations by a plate of copper, and also by a solution of protochloride of tin in excess. Sulphuretted hydrogen gives a black precipitate.

Lime-water and the alkalies give a black precipitate with the salts of the suboxide, and yellow with those of the oxide.

Alloys of mercury are called *amalgams;* it unites with many of the metals and forms a solution, some of which afterwards become solid.

Silver.

How is silver *found* in nature, and where? It is found native, and in combination with sulphur in galena, also combined with gold, antimony, copper, &c. Nearly all the lead of commerce contains

traces of silver. It is found in Mexico, Peru, Hungary, and in the United States.

How is it *procured?* By *amalgamation* and *cupellation*, depending upon the form of ore used. It may be obtained pure from coin by dissolving it in nitric acid, and decomposing the nitrate.

What are its *properties?* It is the clearest white of the metals, receives a beautiful polish, is very malleable, ductile, quite tenacious, soft when pure, and, when fused in open vessels, it absorbs oxygen. It is blackened by sulphur and chlorine. Its equivalent is 108; sp. gr. 10·51; symbol Ag; melts at 1873°.

What are the *compounds* of *silver and oxygen?* They are the suboxide, Ag^2O; the protoxide, AgO. The last is obtained by decomposing the nitrate by potash or soda. It is of a deep-olive color, soluble slightly in water, and forms a fulminating compound with ammonia. It is precipitated in the metallic state by most of the metals; when mercury is employed it assumes an arborescent appearance, called *arbor Dianæ.* And the peroxide, which is unimportant in its chemical relations.

How is the *nitrate of silver*, AgO,NO^5, procured? By the action of nitric acid on silver; when it has been fused it is called *lunar caustic.*

What is the best *test* for silver? Chlorine, and the muriates, which form an insoluble chloride.

How is the *chloride* of silver, AgCl, prepared? It sometimes occurs native, and is called *horn silver;* it is generated when silver is heated in chlorine gas, and may be precipitated by adding hydrochloric acid, or a soluble chloride to the nitrate of silver.

What are its *properties?* It is white, insoluble in water, slightly soluble in acids, but very soluble in ammonia, and is decomposed by hydrogen.

How is the *iodide of silver* procured? By adding the iodide of potassium to a solution of the nitrate of silver. It is greenish yellow, and is soluble in water and ammonia.

How is the *sulphuret of silver* procured? Silver unites with sulphur on exposure to hydrosulphuric acid, and by transmitting this gas through a solution of the nitrate, when it subsides as a dark-brown precipitate, the sulphuret of silver.

Fulminating silver is prepared by dissolving the precipitated oxide in ammonia; and possesses exceedingly dangerous explosive

properties; when dry, the touch of a feather being sufficient to cause it to explode. The reason of this explosive property is that the silver has a feeble affinity for oxygen, while the hydrogen of the ammonia has a powerful affinity for it, so that a slight disturbing cause is sufficient to cause the oxygen and hydrogen to unite. The products of this action are water, nitrogen, and metallic silver.

Solutions of silver are reduced to the metallic state by iron, copper, mercury, &c.

Gold.

How is gold *found* in nature, and where? It is found pure and in combination with other metals, in North and South America, Hungary, and Liberia.

How is gold *obtained* pure? By amalgamation with mercury, and then distilling off the mercury; by making a solution in nitro-hydrochloric acid and precipitating it by the sulphate of iron.

What are the *properties* of gold? It has a yellow color which distinguishes it from all other simple metals, is very malleable and ductile, but inferior to several in brilliancy and tenacity. It has but little affinity for oxygen or sulphur. Its equivalent is 99·4; sp. gr. 19·257; symbol Au. Its *solvent* is chlorine, to which the nitrohydrochloric acid owes its solvent powers.

What are the *oxides* of gold? The protoxide, AuO; the binoxide, AuO^2; and the teroxide, AuO^3.

What is the *test* for gold in solution? The protochloride of tin, which throws down the *purple of Cassius.*

Platinum.

How is platinum *found* in nature, and where? In the metallic state, associated or combined with other metals. It is found in South America, and in the Uralian mountains.

How is it *obtained?* By dissolving the native grains of platinum in aqua regia, or nitro-hydrochloric acid, and adding to it a solution of sal ammoniac, which affords an orange-yellow precipitate. This is to be washed, dried, and exposed to a red heat, which isolates the metal in a porous state, called *platina sponge;* which may be consolidated by mechanical pressure, heat, and hammering.

What are the *properties* of platinum? It has a white color, with a lustre inferior to silver, is malleable, ductile, may be welded

at high temperatures, and is difficult of oxidation or fusion. Chlorine, or solutions which afford it is its proper solvent. It is the heaviest of known metals, equivalent 98·8 ; sp. gr. 21·5 ; symbol Pl.

What are the *compounds* of platinum? There are three oxides, two chlorides, two iodides and two sulphurets.

What is the *test* for platinum? Protochloride of tin, which throws down a claret-colored precipitate.

Alloys and Amalgams.

What is meant by *alloys* and *amalgams*? *Alloys* are combinations of the metals with each other, and, when mercury is a constituent, they are called *amalgams*.

Under what circumstances do metals combine with each other? It is necessary that at least one of them should be liquid, when they will unite if the attraction is energetic.

Do they combine in definite proportions only? They unite in all proportions; yet there appears to be a tendency to unite in definite proportions, as some compounds of this kind occur native.

What are the *general properties* of alloys? They resemble the metals, are opaque, possess metallic lustre, and are good conductors of heat and electricity. The color is sometimes changed from that of its constituents; the hardness is generally increased, consequently the sonorousness is in general increased; the malleability and ductility are usually impaired; the density is sometimes greater, sometimes less; the fusibility is greatly increased, and the tendency to unite with oxygen augmented.

Salts.

How is the class of salts divided? Into *amphigen* and *halogen* salts.

What are the *halogen* salts? They are those salts formed by the union of a salt-radical with a metallic-radical, as common salt ($NaCl$); and are binary in constitution, and included under the compounds of chlorine, iodine, bromine, fluorine, and cyanogen.

What are the *amphigen* salts? They are those formed of elements which have the power of generating both acids and bases,

as sulphate of soda ($NaOSO^3$). In this instance oxygen confers acid properties on the sulphur and basic on the soda.

The amphigen salts are divided into *sub* or *basic* salts, where there is an excess of base over the acid; *neutral*, when there is one equivalent of base and one equivalent of acid, whether they be acid or alkaline. The general rule in the formation of a neutral amphigen salt is: *that there are as many equivalents of acid as there are equivalents of oxygen in the base to which it is attached.* Thus one equivalent of acid is sufficient to neutralize a protoxide; but two equivalents of acid are necesssary to form a neutral salt with one equivalent of a deutoxide. *Super*, or *acid salts*, are those in which the acid is in excess; that is, there may be two equivalents of acid to one of base.

Double salts; these may belong to either of the above classes; thus chloride of sodium will unite with the chloride of mercury, and a double haloidal salt is formed; and sulphate of alumina, united with sulphate of potassa (alum), is a double amphigen salt.

All of the salts are characterized by their taste, and form of their *crystals*, which are *simple* or *compound.*

Cleavage is the tendency of crystals to split in particular directions, and is an indication of a regular structure within.

They are *isomorphous* when they have the same crystalline structure, but differ in chemical composition; and *dimorphous* when the same substance may have two crystalline forms. *Goniometer* is the name given to an instrument for measuring the angles of crystals.

What is meant by *deliquescent* salt? It is where a salt attracts moisture from the atmosphere, and becomes liquid.

What by an *efflorescent* salt? It is where a salt loses its water of crystallization by exposure to the atmosphere, and falls down into a white powder.

What is the *water of crystallization?* It is water which unites with a salt in crystallization, and forms a part of the crystal, but is not an essential ingredient to the existence of the salt.

What is meant by *oxysalts?* Those of which both the acids and bases contain oxygen.

What are the *characteristics* of the *sulphates?* They form white precipitates with the salts of baryta, strontia, and lead, which are

insoluble in nitric acids. Of these tests baryta is considered the best for sulphuric acid, either free or combined.

They are soluble, with the exception of the sulphates of baryta, of the oxides of tin, antimony, bismuth, lead, and mercury. Those sparingly soluble, are the sulphates of strontia, lime, zirconia, yttria, and of the oxides of cerium and silver. The other sulphates are quite soluble in water.

What are the *characteristics* of the *sulphites?* The sulphuric, hydrochloric, phosphoric, and arsenic acids decompose the sulphites with effervescence, owing to the liberation of sulphurous acid gas; they are converted by nitric acid into sulphates.

What is the prominent characteristic of the *nitrates?* They are decomposed invariably at a high temperature.

What is the prominent characteristic of the *nitrites?* By the addition of a strong acid the red fumes of nitrous acid are disengaged.

What is the characteristic of the *chlorates?* They are decomposed at a red heat, oxygen gas is evolved, and a chloride is formed.

What characterizes the *chlorites?* They are soluble in water, and possess high bleaching and oxidizing properties.

What characterizes the *iodates?* They are similar to the chlorates, iodides being formed of course, instead of chlorides, when heated.

What characterizes the *arseniates?* When heated to redness with charcoal they are decomposed, and metallic arsenic is set at liberty.

What characterizes the *chromates?* They are generally either of a red or yellow color, are decomposed by heat, and the acid is resolved into green oxide of chromium and oxygen gas.

What characterizes the *carbonates?* Their decomposition with effervescence by nearly all the acids, and most of them are decomposed by heat.

How may the salts of *ammonia* be distinguished? By the addition of pure potassa, when the odor of ammonia is given off.

How may the *hydrosulphates* be distinguished? By hydrosulphuric acid being expelled with effervescence by other acids.

What is understood by *sulphur-salts?* They are double sulphurets, as the oxysalts are double oxides; the sulphuret of one

metal acting as an acid, while the sulphuret of another metal acts as a base. Kermes mineral, for instance, is an example of a sulphur salt, being sulphuret of antimony united with sulphuret of potassium.

ORGANIC CHEMISTRY.

What is understood by organic chemistry? It comprehends the history of those compounds which are of animal or vegetable origin.

What are the *simple elements* coming under notice in organic chemistry? They are carbon, hydrogen, oxygen, and nitrogen, with traces of phosphorus, sulphur, iron, silicic acid, potassa, lime, &c.

The mode of union differs from that in the inorganic kingdom. In that, union takes place by *pairs* of elements; thus—copper and oxygen combine to form oxide of copper; potassium and oxygen to potash; sulphur and oxygen to sulphuric acid; sulphuric acid then combines with oxide of copper and of potassium; by which a pair of salts is formed, that are again capable of uniting to form a double compound, $CuO,SO^3 + KO,SO^3$. The most complicated products may be formed in this way. In organic chemistry it is different; the union of the elements, no matter how complex, seems to be simultaneous. In sugar, $C^{24}H^{22}O^{22}$, or morphia, $C^{35}H^{20}NO^6$, and numerous other similar cases, the elements are bound up together, as a single whole, which may enter into combination with other substances, and be disengaged with properties unchanged.

Are organic substances liable to *decomposition*? Yes; they are very prone to decomposition, the tendency of carbon and hydrogen being to appropriate to themselves as much oxygen as will form carbonic acid and water; and, when the oxygen is insufficient, carbonic oxide and carburetted hydrogen are formed. When the organic substance contains nitrogen it is very prone to decomposition, and water, carbonic acid, hydrocyanic acid, and ammonia are formed. They are all decomposed at a red heat, and nearly all below this temperature.

What are the particular *characteristics* of organic products? They are composed of the same elements, undergo spontaneous

decomposition with facility, cannot be formed by the direct union of their elements, and are decomposed at a red heat.

The more complex the constitution, the greater the liability to decomposition; this disposition is less where the elements *saturate* each other. Animal matter is generally *quaternary*, and more liable to decomposition than vegetable, which is usually *ternary*.

Isomeric bodies are numerous, and this condition is supposed to depend upon a *different arrangement* in the constituent atoms, the number being the same.

What is understood by the term *compound radicles?* They are combinations that perform the functions of elementary bodies. The following are the most important examples of this class: —

	Formula.
Carbonic oxide, or protoxide of carbon	CO
Cyanogen, or bicarburet of nitrogen	C^2N
Mellon, or sesquicarburet of nitrogen	C^6N^4
Benzoile, benzule, or benzyle	$C^{14}H^5O^2$
Cinnamyl, or cinnamule	$C^{18}H^8O^2$
Salycyle, or salicule	$C^{14}H^5O^4$
Acetyl, or acetule	C^4H^3
Formyl, or formule	C^2H
Amide	NH^2
Ethyl, or ethule	C^4H^5
Methyl, or methule	C^2H^3
Cetyl, or cetule	$C^{32}H^{33}$
Glyceryl, or glycerule	C^6H^7
Amyl, or amule	$C^{10}H^{11}$
Mesetyl, or mesetule	C^6H^4
Kacodyl, or kacodule	$C^4H^6As.$

Vegetable Chemistry.

What are the *simple elements* of vegetable substances? Oxygen, hydrogen, carbon, and a few contain nitrogen.

What is meant by the *proximate* or *immediate principle* of vegetables? They are compounds which exist ready formed in plants, such as sugar, starch and gum.

What is meant by the proximate analysis of vegetables? It is the process of separating the proximate principles from each other, and the reduction of the proximate principles into their simplest parts constitutes their ultimate analysis.

How may vegetable substances be arranged? Into the *vegetable acids*, the *vegetable alkalies; neutral substances*, the *oxygen and hydrogen of which are in the ratio to form water;* the *oleaginous, resinous*, and *bituminous principles;* the *spirituous* and *ethereal principles; coloring matter;* and *compounds which cannot be classed under the preceding heads.*

Vegetable Acids.

What are the vegetable acids? They are compounds possessing acid properties, which are products of vegetation.

What are the general *properties* of vegetable acids? They are decomposed at a red heat, less liable to spontaneous decomposition than other vegetable substances, decomposed by hot nitric acid, by which they are converted into carbonic acid and water, and nearly all are polybasic.

Is oxygen always in a proportion above that for forming water in vegetable acids? Generally, but not always; sometimes it is even in a less proportion, as in benzoic acid; but when there is more oxygen than suffices to form water with hydrogen, the vegetable substances are always acid.

Where is *Oxalic acid*, C^2O^3,HO, or $2CO + O + HO$, found? In several plants ready formed, as in the *rumex acetosa*, or *common sorrel;* the *oxalis acetosella*, or *wood sorrel;* and it may be prepared by digesting sugar with nitric acid.

What are the *properties* of oxalic acid? It crystallizes in slender, flattened, four and six-sided prisms, terminated by six-sided summits, but the primary form is an oblique rhombic prism; it has a sour taste, reddens litmus, and forms neutral salts with alkalies, and is very soluble in water. It is powerfully poisonous, and is frequently taken by mistake for epsom salts, which it resembles. *Chalk* is its *antidote*, with which it forms an insoluble *oxalate of lime.* It is distinguished from all other acids by the form of its crystals, and by its solution giving, with lime-water, a white insoluble precipitate. It contains the elements of carbonic acid and carbonic oxide, into which it is decomposed by the action of a strong acid. It is monobasic, but will unite in more than one proportion to a single equivalent of base.

The *salts* of oxalic acid are *neutral oxalate of potassa*, KO,C^2O^3,HO; *binoxalate of potassa*, called *salt of sorrel*, and exists in

oxalis acetosella, or *sorrel,* and in *garden rhubarb.* Formula $KO,2(C^2O^3) + 3HO$. *Quadoxalate of potassa,* $KO,4(C^2O^3) + 7HO$. *Oxalate of ammonia,* $NH^4O,C^2O^3 + HO$. This last is used as a test for lime.

Where is *Acetic acid,* $C^4H^3O^3 + HO$, found? It exists in the sap of many plants, either free or combined; it is generated by the destructive distillation of vegetable matter, and is produced by the acetous fermentation. It is best obtained pure and concentrated by decomposing the acetates by sulphuric acid. For chemical purposes it is obtained by the destructive distillation of wood, and sold under the name of *pyroligneous acid.*

How is acetic acid *distinguished?* By its flavor, odor, and volatility. Its salts are called *acetates,* and are all soluble in hot, and most of them in cold water; formula, $HO,C^4H^3O^3$.

Where is *Lactic acid* found? In sour milk, and in the beet root; formula, $HO,C^6H^5O^5$.

Where is *Kinic acid* found? In cinchona bark, in combination with lime, quinia, and cinchona; formula, $C^{11}H^{11}O^{11}HO$.

Where is *Malic acid* found? In the acidulous fruits, such as grapes, oranges, currants, apples, &c.; formula, $2HO,C^8H^4O^8$.

Where is *Citric acid* found? In the juice of the lime and lemon; formula, $3HO,C^{12}H^5O^{11}$.

From what is *Tartaric acid* procured? It exists in the juice of some of the acidulous fruits, but generally in combination with lime or potassa.

It is prepared by mixing chalk with cream of tartar, from which the tartrate of lime is thrown down, and the tartrate of potassa remains in solution; to the tartrate of lime sulphuric acid is added, and the tartaric acid is set at liberty.

What are the *properties* of tartaric acid? It has an agreeable sour taste, reddens litmus, and forms with alkalies neutral salts, called *tartrates.* It is distinguished by forming a white precipitate, the bitartrate of potassa, when mixed with any of the salts of potassa; it, therefore, separates potassa from the other acids, and produces a precipitate with lime, which is soluble in an excess of the acid. It is remarkable in forming double salts, the most important of which are those of *potassa* and *soda,* or the *Rochelle salt,* and of *oxide of antimony and potassa,* or *tartar emetic;* formula, $2HO,C^8H^4O^{10}$.

What is the *cream of tartar* of the shops? It is the *bitartrate of potassa;* in an impure state known by the name of *tartar*, or *argol*, it is found encrusted on the sides and bottom of wine casks; being insoluble in alcohol, it is deposited as alcohol is formed during the vinous fermentation; formula, $KO,HO,C^8H^4O^{10}$.

Tartrate of potassa, $2KO,C^8H^4O^{10}$; or *soluble tartar*. *Tartrate of potassa and soda*, or *Rochelle salt*, $KO,NaO,C^8H^4O^{10}+10HO$.

Where is *Benzoic acid* found? In gum benzoin, storax, balsam of Peru, Tolu, &c.; also in the urine of the cow and of children. It is generally procured from gum benzoin; formula, $HO,C^{14}H^5O^3$.

Where is *Meconic acid* found? It is found only in opium combined with morphia. It is known by forming with the sesquisalts of iron a blood-red color, which renders it valuable as a test for opium; formula, $3HO,C_{14}HO_{11}$.

Where is *tannic acid*, or *Tannin*, found? In the excrescences of the oak, called gall nuts, in the bark of most trees, in kino, catechu, the tea plant, sumach, uva ursi, and in astringent plants generally; it is the principal cause of astringency in vegetables.

What are the *properties* of tannic acid? It is colorless, inodorous, has an astringent taste, no bitterness, and may be kept in the solid state. It is soluble, reddens litmus, and decomposes the carbonates. It strikes a deep-blue precipitate with the sesqui-salts of iron, but not with the proto-salts, which distinguishes it from all other substances except gallic acid, and from this it may be distinguished by yielding, with a solution of gelatin, a white, flaky precipitate, soluble in a solution of gelatin, but insoluble in water and gallic acid. This compound of tannic acid and gelatin, called *tanno-gelatin*, is the basis of leather; formula, $3HO,C^{18}H^5O^9$.

Where is *Gallic acid* found? In most substances which contain tannic acid, and is probably developed by the oxidation of that acid. It does not precipitate gelatin or the salts of the vegetable alkalies; formula, $2HO,C^7HO^3$.

How is the Succinic acid obtained? By heating powdered amber in a retort; formula, $2HO,C^8H^4O^6$.

Organic Salt Bases, or Vegetable Alkalies.

What is understood by vegetable alkalies? They are those proximate vegetable principles which possess alkaline properties. They all contain nitrogen, are decomposed by a moderate heat, and are but slightly soluble in water.

What is their *composition*? Carbon, hydrogen (in greater proportion than to form water), nitrogen, and oxygen; and they always exist in combination with an acid.

How are they generally procured? The substance containing the alkaline principle is digested or macerated in a large quantity of water to dissolve the salt, of which the alkali is the base. Then add a powerful salifiable base, which unites with the acid, the alkaline base is set at liberty, may be collected on a filter, purified by solution in boiling alcohol, and evaporated to dryness.

What are some of the most prominent vegetable alkalies? —

Morphia	$C^{35}H^{20}NO^{6}$
Codeia	$C^{35}H^{20}NO^{5}$
Thebaia, Narceia	composition not known.
Narcotina	$C^{18}H^{24}NO^{1}$
Coneia	$C^{16}H^{1}N$
Nicotia	$C^{10}H^{8}N$
Quinia	$C^{20}H^{12}NO^{2}$
Cinchonia	$C^{20}H^{12}NO$
Aricina	$C^{29}H^{12}NO^{3}$
Strychnia	$C^{44}H\ N^{2}O$
Brucia	$C^{44}H\ N^{2}O^{7}$
Veratria	$C^{34}H^{22}NO^{6}$
Aconitina	
Caffein, Thein	$C^{8}H^{5}N^{2}O^{3}$
Theobromin	$CH^{95}N^{3}O^{2}$

Where is *Morphia*, $C^{25}H^{30}NO^{6}$, found in nature? It is the medicinal agent of opium, in which it is combined with meconic and sulphuric acids, and other foreign matters.

What are the *properties* of morphia? Colorless crystals of a brilliant lustre, and in irregular, six-sided prisms, may be obtained from the alcoholic solution. It is insoluble in cold, and slightly

in hot water, tasteless when pure, but very bitter when dissolved in alcohol, or rendered soluble by means of an acid. Strong nitric acid converts it into oxalic acid, and, with a sesquisalt of iron, it strikes a blue tint. It is almost inert when pure, from its insolubility, but when in solution it acts with great energy. By decomposing a salt of morphia by ammonia, when taken into the stomach, the effects of an over-dose may be prevented. It decomposes iodic acid, and sets iodine free, which may be recognised by starch, its appropriate test; one grain of pure morphia in 7000 grains of water may be recognised by this test.

It forms a *sulphate*, an *acetate*, a *phosphate*, a *chloride*, &c.

Where are *Cinchonia* and *Quinia* found? In the cinchonia bark, in union with kinic acid.

How are they *procured?* By taking up the soluble parts of the bark by hot water, acidulated with hydrochloric acid; concentrate the solution, and digest with successively added portions of slaked lime until the liquid becomes alkaline. The precipitate is carefully collected, and the vegetable alkali separated by boiling alcohol.

What are the *properties* of cinchonia, $C^{20}H^{12}NO$? When pure it crystallizes in colorless, quadrilateral prisms, insoluble in cold, slightly soluble in hot water, and very soluble in boiling alcohol. It has a very bitter taste when dissolved by alcohol, or an acid; and forms salts with acids.

What are the properties of *quinia*, or *quinine*, $C^{20}H^{12}NO^2$? It is precipitated from its solutions by alkalies in white flocks, which do not crystallize; very soluble in alcohol and ether, but very slightly so in water. Its medicinal virtues are more powerful than those of cinchonia. It forms salts with acids, the most important of which is the *disulphate*, and is prepared in large quantities for medicinal purposes, crystallizing in delicate white, needle-shaped crystals.

The sulphate of quinia is frequently adulterated; and the substances generally employed are water, sugar, starch, gum, ammoniacal and earthy salts. When pure it should only lose 8 or 10 per cent. of water of crystallization by heat. The other impurities may be detected by the appropriate means.

Where is *Strychnia*, $C^{44}H^{23}N^2O^4$, found? In the fruit of the *strychnos ignatia*, and the *strychnos nux vomica*, and has also been extracted from the *Upas*.

What are the *properties* of strychnia? It is soluble in boiling alcohol, and by evaporation it is procured in four-sided prisms. It is a virulent poison, producing death in a very short time if taken in sufficient quantity. It action is accompanied by tetanic symptoms.

Caffein, or *Thein*, $C^6H^5N^2O^2$, found in tea, coffee, and maté, may be prepared by adding subacetate of lead to a decoction of tea, coffee, or maté; then removing the lead by sulphuretted hydrogen, and adding ammonia. The caffein crystallizes out in tufts of white, silky needles, which have a bitter taste, and sublime without decomposition.

Neutral Substances, the Oxygen and Hydrogen of which are in the same ratio as in Water: or the Amylum series.

What substances are included in this class?

Lignin	$C^{12}H^8O^8$
Gum Arabic Cane sugar	$C^{12}H^{11}O^{11}$
Sugar of milk	$C^{12}H^{12}O^{12}$
Sugar of ergot	$C^{12}H^{13}O^{13}$
Glucose, or sugar of grapes Sugar of starch Diabetic sugar	$C^{12}H^{14}O^{14}$
Starch Cellulose Tragacanthus Dextrine.	$C^{12}H^{10}O^{10}$
Mannite	$C^6H^7O^6$

Oleaginous, Resinous, and Bituminous Substances.

What is remarkable in this class of bodies? Their combustibility, besides other properties common to each. They generally contain hydrogen in a larger proportion than is necessary to form water with their oxygen, and they exert a feeble affinity for other bodies.

What are the characteristics of *Oils?* They are inflammable, have a peculiar unctuous feel, and are insolnble in water. They are divided into *fixed* and *volatile;* the former gives a permanent,

greasy stain to paper; and the latter produces one which disappears by a gentle heat.

Where are *fixed oils* usually found? In animals and in the seeds of plants, but olive oil is procured from the pulp which surrounds the stone. These oils are obtained by roasting the seeds, and subjecting the pulpy matter to pressure and a gentle heat.

They absorb oxygen, and become rancid when exposed to the atmosphere, or to oxygen gas; they also unite with alkalies and form soap.

What are their component parts? Stearine and margarine, or the hard portion; and elaine or oleine.

TABLE OF FATS, FATTY ACIDS, AND BASE.

Fats.

Stearine	$C^{71}H^{70}O^{80}$
Margarine.	
Oleine.	

Fatty Acids.

Stearic acid	$C^{68}H^{66}O^{5} + 2HO$
Margaric acid	$C^{68}H^{66}O^{6} + 2HO$
Oleic acid	$C^{44}H^{40}O^{4} + 2HO$

Base.

Glycerine	$C^{6}H^{8}O^{6}$, or $C^{6}H^{7}O^{5} + HO$

Stearine, $C^{71}H^{70}O^{80}$, the solid constituent of fat, may be obtained by melting mutton suet in ether, and allowing the whole to cool, when the stearine will crystallize. It is white, friable, insoluble in water and alcohol, but soluble in boiling ether; melts at 130° F. Chemically it is a *stearate of glycerine.*

Stearic acid, $C^{68}H^{66}O^{5} + 2HO$, may be obtained by saponifying stearine, and then adding an acid, which separates it from the glycerine.

Margarine may be obtained from the ethereal solution of mutton suet after the removal of the stearine. It resembles stearine, but is more fusible; melts at 116°. It is a *margarite of glycerine.*

Margaric acid, $C^{68}H^{66}O^{6} + 2HO$, resembles the stearic, but is more soluble in alcohol. Melts at 140°, and has one more equivalent of oxygen. It is obtained from margarine by saponification.

Oleine may be obtained from paper, by which it has been ab sorbed in preparing margarine; also by filtering the fixed oils at the freezing temperature. Resembles oil in appearance, colorless when pure, and congeals at 20° F.; soluble in boiling alcohol an ether; insoluble in water. It is an *oleate of glycerine.*

Oleic acid, $C^{44}H^{40}O^{4} + 2HO$, is procured also by the saponifica tion of olein, which it resembles very much. It is void of color, lighter than water, has acid properties, and is soluble in alcohol.

Glycerine, $C^{6}H^{8}O^{6}$, or $C^{6}H^{7}O^{5} + HO$, the base common to all fats; obtained by forming an insoluble soap with olive oil, oxide of lead, and water. The oleo-margarate of the oxide of lead is formed (lead-plaster), and is precipitated, while the glycerine remains in solution, from which it may be obtained by evaporation in vacuo; void of color when pure, viscid, sp. gr. 1·27, sweetish taste, soluble in water, and is converted by nitric acid into oxalic acid. It is said to be a hydrated oxide of a hypothetical base called *glycerile.* Thus: — Glycerile, $C^{6}H^{7}$; oxide of glycerile, $C^{6}H^{7}O^{5}$; glycerine, the hydrated oxide of glycerile, $C^{6}H^{7}O^{5} + HO$.

Acroline, $C^{6}H^{4}O^{2}$, may be obtained by the destructive distillation of fats, in a gaseous form, which, when condensed, forms a volatile poisonous liquid.

Butyric, *capric*, and *caproic* acids are found in butter, in addition to the other ingredients found in fats.

Wax is analogous to fats; it is composed of *cerine*, which is soluble in alcohol and water, and will form soap; and of *myricene*, which is insoluble in water and alcohol, and will form a soap.

Where are *volatile* or *essential oils* found? In aromatic plants, from which they are obtained by distillation.

They will not leave a greasy spot or stain, are converted into vapor at slight elevations of the temperature, colorless when pure, powerful odor, pungent burning taste, do not saponify, when exposed to the air absorb oxygen, and are converted into resins, and they also deposit a crystalline matter called *stearopten*, when standing some time. They have been divided into those which contain oxygen, and those having sulphur and nitrogen in their composition.

TABLE OF SOME VOLATILE OILS WHICH ARE PURE CARBO-HYDROGENS

Oil of Lemons	$C^{10}H^8$
" Copaiba.	$C^{10}H^8$
" Calamus	$C^{10}H^8$
" Turpentine	$C^{20}H^{16}$
" Savin.	$C^{20}H^{16}$
" Cloves	$C^{20}H^{16}$
" Black pepper, &c.,	$C^{20}H^{16}$
" Cubebs.	$C^{15}H^{16}$
" Juniper	$C^{15}H^{16}$
" Roses	CH
&c., &c.	

OILS CONTAINING CARBON, HYDROGEN, AND OXYGEN.

Oil of Pennyroyal	$C^{10}H^8O$
" Rosemary	$C^{10}H^8 + 2HO$
" Bergamot	$C^{10}H^8 + 2HO$
" Peppermint	$C^{20}H^{20} + 2HO$
" Camphor	$C^{20}H^{16}O$
Artificial camphor	$C^{20}H^{12}Cl^4$

SULPHURIZED OILS.

Oil of Black Mustard	$C^{32}H^{20}N^4S^5O^5$
" " Onions	Contain sulphur and nitrogen, but have not yet been analyzed.
" " Assafœtida	
" " Horseradish	

What oil is procured from *bitter almonds?* When bruised and subjected to compression, they yield a pure fixed oil; but when distilled with water a poisonous volatile oil passes over, which contains *hydrocyanic acid.*

What are *Resins?* The inspissated juices of plants, either pure or in combination with essential oils. They are solid, brittle, inodorous, insipid, and generally of a yellow color; semi-transparent, non-conductors of electricity, and negatively electric when rubbed.

The most important of the resins are *common resin, copal, lac, sandarach, mastich, elemi,* and *dragons-blood.*

Resin, or *colophony,* is the best representative of this class. It is the residue after distilling oil of turpentine, and is composed of two acids, the *pinic* and *silvic,* the composition being the same,

$C^{20}H^{15}O^{2}$; the pinic is more soluble in alcohol; thus affording a means of separating them.

Caoutchouc is the product of several trees of tropical countries, which exude a milky juice that hardens by exposure to the air. When pure it is nearly white: the usual dark color is owing to smoke and impurities. Naphtha, ether, essential oils, and sulphide of carbon dissolve it perfectly, and are its proper solvents. It melts at a temperature above boiling water, but does not resume its former elasticity.

Gutta percha resembles caoutchouc, and is the concrete juice of a tree growing in Borneo. It softens at a high temperature, and may be moulded into any shape, resuming its solidity on cooling. Dissolves in ether, volatile oils, and chloroform. It promises to afford many useful applications.

What are *Balsams*? They are compounds of resin, volatile oil, and benzoic acid.

What are *Gum-resins*? They are the concrete juice of plants which contain *resin*, *essential oil*, *gum*, and *extractive matter*. Their proper solvent is proof spirit. Under this head are *aloes*, *ammoniacum*, *assafœtida*, *euphorbium*, *galbanum*, *gamboge*, *myrrh*, *scammony*, and *guaiacum*.

How are *Bituminous substances* divided? Into *bitumen* and *pit coal;* under the *first head* are *naphtha*, *petroleum*, *mineral tar*, *asphaltum*, *mineral pitch*, and *retina-sphaltum;* and under the *latter head* are *brown coal*, *common* or *black coal*, and *glance coal*, or *anthracite*.

Spirituous and Ethereal Substances.

Alcohol.

Is alcohol the intoxicating ingredient in all spirituous and vinous liquors? It is; and is always a product of the *vinous fermentation;* therefore, does not exist ready formed in plants.

How is the alcohol *procured* pure? By the addition of heated carbonate of potash (or any other substance having a strong affinity for water) to spirit of wine; the potash unites with the water, subsides, and the alcohol may be decanted pure. The chemical term for alcohol is the *hydrated oxide of ethyle*, $C^4H^5O + HO$.

Ether.

How is ether procured? By heating the stronger acids with alcohol; the different kinds are distinguished by the name of the acids used in their preparation.

Ether contains C^4H^5O; in reference to acids, it resembles a base which has been supposed to be the oxide of a metalloid or hypothetical radical, called *ethyle*, analogous to cyanogen and kakodyle.

Ethyle, symbol Ae, C^4H^5. Oxide of ethyle; ether, C^4H^5O. Hydrate of the oxide of ethyle; alcohol, $C^4H^5O + HO$. Considering ether to be an oxide of ethyle, it is found to be capable of uniting with oxy-acids, and forming with them salts; while the halogen bodies unite directly with the radical as they do with metallic bodies.

Chloroform.

How is chloroform obtained? By distilling alcohol with chloride of lime, or bleaching powders.

What are its *properties*? It is a colorless, transparent liquid; sp. gr. 1·48, of the vapor 4·199. It is not combustible; its vapor is decomposed at red heat; it is insoluble in water, but is readily in alcohol and ether. Formula, C^2HCl^3, or $FoCl^3$.

Coloring Matters.

What are the prevailing colors of vegetables? *Red*, *yellow*, *blue*, and *green*, or their *mixtures*.

Does vegetable coloring matter occur in an insulated state? No; it is always attached to some proximate principle, such as mucilaginous, extractive, or resinous substances, by which its properties are influenced.

It is generally decomposed by the combined agency of the sun's rays, and a moist atmosphere; and all of them are destroyed by chlorine.

What is meant by *lakes*? They are insoluble compounds formed by coloring matter with some of the metallic oxides.

What is meant by the term *mordant*, or *basis*? It is a substance having an affinity both for the coloring matter, and the article to

be colored; which, by combining with each at the same time, causes the dye to be permanent.

Those coloring substances which adhere to the cloth without a basis, are called *substantive* colors, and those which require a basis, *adjective* colors.

What substances produce the *blue dyes?* *Indigo.*

What the *red?* *Cochineal, lac, archil, madder, brazil-wood, logwood,* and *safflower.*

The *yellow?* *Quercitron bark, turmeric, wild American hickory, fustic,* and *saffron;* all of which are adjective colors.

The *black?* The same ingredients as writing ink; and is, therefore, essentially *oxide of iron* with *gallic acid* and *tannin.*

Substances which do not belong to either of the preceding sections.

What are the articles belonging to this class? *Vegetable albumen, gluten, yeast, asparagin, bassorin, cathartin, fungin, suberin, ulmin, lupulin, inulin, medullin, piperin, olivile, sarcocoll, rhubarbarin, rhaponticin, colocyntin, berberin, bryonin, gentianin, zanthopicrin, scillitin, senegin, saponin, arthanatin, plumbagin, chlorophyle, amygdalin, salicin, populin, meconin, columbin, elatin, sinapisin,* &c.

Spontaneous changes of Vegetable Matter.

What is *Fermentation?* It is certain spontaneous changes which vegetable substances undergo when the vital principle is extinct. It is divided into four distinct kinds, viz: the *saccharine, vinous, acetous,* and *putrefactive.*

What substances undergo the *saccharine fermentation?* Starch is the only one known to be subject to this fermentation, which takes place when it is kept in a moist state for some time; and sugar equal to half the weight of the starch employed is formed.

What circumstances are necessary to the *vinous fermentation?* The presence of *sugar, water, yeast,* or some *ferment,* and a certain *temperature.* The changes which take place are the disappearance of sugar, the formation of alcohol, and the escape of carbonic acid gas.

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Under what circumstances does the *acetous fermentation* take place? When a liquid which has undergone the vinous fermentation is mixed with yeast, and exposed to the open air. In this process oxygen is absorbed, and carbonic acid gas is disengaged.

What circumstances are necessary to the *putrefactive fermentation?* The accompanying circumstances which enable this process to take place, are moisture, air, and a certain temperature; the most favorable temperature is between 60 and 100 degrees.

The principal products are water, light carburetted hydrogen, carbonic acid, and, when nitrogen is present, ammonia. The solid remains are charcoal, combined with oxygen and hydrogen.

Germination.

What conditions are necessary to germination? *Moisture*, a *certain temperature*, and *oxygen gas?* Light, which is favorable to the subsequent stages of vegetation, is injurious to germination.

Animal Chemistry.

What is meant by *proximate* animal principles? They are distinct compounds derived from the bodies of animals.

How are they *distinguished* from vegetable matter? By the presence of nitrogen, their strong tendency to putrefy, and the offensive products of putrefaction. Some vegetable principles contain nitrogen, but they do not putrefy readily.

What are the *essential constituents* of animal compounds? *Carbon*, *oxygen*, *hydrogen*, and *nitrogen;* besides, some of them contain *phosphorus*, *sulphur*, *iron*, *earthy*, and *saline matters.*

What effect has *heat* upon them when applied in a close vessel? They yield *water*, *carbonic oxide*, *carburetted hydrogen*, *carbonate* and *hydrocyanate of ammonia*, a *fetid*, *thick oil*, and *carbonaceous matter*, which is a powerful decolorizing agent.

What is the principle of the *mode* of *analyzing* animal and vegetable substances? It is to convert the whole of the carbon contained into carbonic acid, and the hydrogen into water.

What is understood by *protein compounds?* Substances which contain *protein;* the principal ones are albumen, $Pt^{10}+S^2P$; fibrin, $Pt^{10}+SP$; and casein, $Pt^{10}+S$.

Protein, $C^{48}H^{36}N^{6}O^{12} + P + S$, symbol Pt. It may be obtained by dissolving bodies in which it is contained, in caustic alkali, and then adding an excess of acid (the acetic usually); a snow-white precipitate is thrown down, which is protein. It is tasteless, insoluble in water and alcohol, but soluble in acetic acid, and in solutions of the alkalies. It acts both as an acid and a base.

How are animal products divided? 1st. Into those which are neither acid nor oleaginous; 2d, the acids; and, 3d, the oils and fats.

What substances are included in the first division? Fibrin, albumen, casein, gelatin, urea, sugar of milk, and sugar of diabetes.

In what does *Fibrin*, $Pt^{10}+SP$, exist? In muscle, chyle, and blood. It is solid, white, insipid, and inodorous.

Where is *Albumen*, $Pt^{10}+S^{2}P$, found? In the white of eggs, and in the serum of the blood.

What are the properties of albumen? It is precipitated by corrosive sublimate, which is its best test; and it is coagulated by heat, alcohol, and the stronger acids.

Where is *Gelatin* found? In the skin, cartilages, membranes, and bones.

What are its *properties*? It is readily soluble in water, and forms a jelly when cool; it is known in commerce by the name of glue; tannic acid is its appropriate test.

Where is *Urea* found? It is procured from fresh urine.

Where is *Pepsin* found? Called also *gasterase*, and exists in the epithelial cells of the mucous membrane of the stomach. It is found in the gastric juice, held in solution by the acids of the stomach. It may be obtained by dissolving the mucous membrane of the stomach in acidulated water, and adding a subacetate of lead; the pepsin is precipitated with lead and albumen; the lead may be removed by sulphuretted hydrogen, and the albumen by heat, leaving the pepsin.

What are the *proximate principles* of animal oils? The same as are formed in the vegetable.

What circumstances are necessary to the *putrefaction* of animal substances? *Water*, *air*, and a *certain temperature*.

What are the *products* of putrefaction? *Water*, *ammonia*, *carbonic* and *acetic acids*, *carburetted* and *sulphuretted hydrogen*, and *phosphureted hydrogen* in some cases.

ANALYTICAL CHEMISTRY.

By what process do you analyze a gaseous mixture containing *oxygen?* Introduce into the mixture a quantity of hydrogen, more than sufficient to saturate the oxygen present, carefully measure the whole, pass an electric spark through it, or introduce into it a piece of spongy platinum, and note the diminution; divide the diminution by three, and you have the quantity of oxygen originally in the mixture.

What is the process when the quantity of *nitrogen* is to be determined? The method is to withdraw all other gaseous substances with which it is mixed.

What is the mode of determining the quantity of *carbonic acid* in gaseous mixtures? By agitating the mixture with lime-water, or a solution of caustic potassa, and noting the deficiency.

What is the mode of determining the quantity of *hydrogen?* By causing it to combine with oxygen by the electric spark, or platinum. The principle is the same for the inflammable gases, chlorine being used for some of them instead of oxygen.

What is the general mode pursued in the analysis of *organic bodies?* It is to present oxygen to the organic body and apply heat; the carbon is thus converted into carbonic acid, and its hydrogen into water; when nitrogen is present ammonia is formed. The best means of supplying the oxygen is by means of the black oxide of copper.

TABLE OF SYMBOLS AND CHEMICAL EQUIVALENTS OF ELEMENTARY SUBSTANCES.

Ele.	*Eq.*	*Sy*	*Ele.*	*Eq.*	*Sy.*
Aluminum	13·7	Al	Carbon	6	C
Antimony			Cerium	46	Ce
(Stibium)	129·4	Sb	Chlorine	35·50	Cl
Arsenic	75	As	Chromium	28	Cr
Barium	68·7	Ba	Cobalt	29·5	Co
Bismuth	71	Bi	Columbium		
Boron	10·9	B	(Tantalum)	185	Ta
Bromine	78·4	Br	Copper		
Cadmium	55·8	Cd	(Cuprum)	31·6	Cu
Calcium	20	Ca	Fluorine	18·68	F

Ele.	*Eq.*	*Sy.*
Glucinium	26·50	G
Gold (Aurum)	199·2	Au
Hydrogen	1	H
Iodine	126·3	I
Iridium	98·8	Ir
Iron (Ferrum)	28	Fe
Lantanum		Ln
Lead (Plumbum)	103·6	Pb
Lithium	6·44	L
Magnesium	12·7	Mg
Manganese	27·7	Mn
Mercury (Hydrargyrum)	101	Hg
Molybdenum	47·7	Mo
Nickel	29·5	Ni
Nitrogen	14	N
Osmium	99.7	Os
Oxygen	8	O
Palladium	53·3	Pd
Phosphorus	32	P
Platinum	98·8	Pl
Potassium (Kalium)	39·15	K
Rhodium	52·2	R
Selenium	39·6	Se
Silver (Argentum)	108	Ag
Silicium	21·35	Si
Sodium (Natrium)	23·3	Na
Strontium	43·8	Sr
Sulphur	16	S
Tellurium	64·2	Te
Thorium	59·6	Th
Tin (Stannum)	58·9	Sn
Titanium	24·3	Ti
Tungsten (Wolfram)	94·8	W
Uranium	60	U
Vanadium	68·5	V
Yttrium	32·2	Y
Zinc	32·3	Zn
Zirconium	33·7	Zr

PART IV.

POISONS.

PART IV.—POISONS.

What are *Poisons?* They are substances, which, when introduced into the animal economy by any means, act in a noxious manner on the vital properties or texture of organs.

Are poisons similar in their action? No; each one produces symptoms somewhat peculiar to itself; although poisons of a particular class may resemble each other very much in their effects.

How many kinds of *antidotes* are there? Two; one destroys the deleterious qualities of poisons, by a change of composition, before its injurious action is developed; and the other controls the poisonous action after it has been established. The former is of great consequence; the latter of but very little, if considered as a specific antidote, independent of the general condition of the system.

What other means are resorted to? Evacuation of the stomach, either by an emetic, or stomach-pump, when taken internally; and by excision, or the application of a cupping-glass, if applied externally.

Acids.

What are the poisonous acids? The *Acetic*, *Citric*, *Muriatic*, *Nitric*, *Sulphuric*, *Tartaric*, *Oxalic*, and *Prussic*.

What are the *symptoms* produced by them? With the exception of the prussic, they are generally strong corrosive poisons; producing a burning heat in the mouth, throat, œsophagus, and stomach; acute pain, eructations, nausea, hiccough, vomiting, tenderness of the abdomen, coldness of the surface and extremities, depressed pulse, horrible contortions, excessive thirst; and, when taken in large quantities, a fatal termination.

What is the *treatment?* The alkalies, alkaline earths, and their carbonates, as antidotes for all the acids except the nitric and oxalic; and for these magnesia and lime only, or their carbonates, are to be used. Lime in some form or other, as in chalk, or in plastering on the wall, is generally the nearest at hand, and should be used in an emergency. To obviate the effects of the poison use mucilaginous drinks, olive or almond oil in large quantitities, emollient fomentations, and clysters.

In what forms does *prussic acid* exist, in which it may be taken into the system? That of *prussic* or *hydrocyanic acid*, *oil of bitter almonds*, and *laurel water*.

What are the *symptoms?* It is a sedative poison, and is so rapid in its action that it is seldom treated by a physician. When it is not at once fatal, the symptoms are sudden loss of sense, trismus, difficult, and rattling respiration, coldness of the extremities, a smell of bitter almonds proceeding from the mouth, small pulse, swelling of the neck, immobility of the pupils, sometimes contracted, and at others dilated, convulsions, &c.

What is the *treatment?* The antidotes are ammonia, cold affusion, artificial respiration, and Smith's antidote, which consists in administering a solution of carbonate of potash, followed by a dilute solution of old sulphate of iron, by which Prussian blue is formed, a compound not poisonous.

What are the *tests* for the acids? *Sulphuric acid* is precipitated by any salt of *baryta*, and the precipitate is insoluble in nitric acid.

Muriatic gives a white precipitate with the *nitrate of silver*, which turns black by exposure to light.

Nitric gives orange-colored fumes when put on *copper*, and dissolves gold when mixed with muriatic acid.

Acetic gives the odor of vinegar.

Citric blackens when heated.

Tartaric precipitates crystals with a solution of potassa. *Oxalic* gives a white precipitate with lime-water.

Alkalies and their Salts.

What articles are included under this head? *Ammonia*, and *Muriate of Ammonia; Potassa, caustic* and the *liquor potassæ;*

the *carbonate*, the *nitrate*, or *saltpetre;* and the *sulphuret*, or *liver of sulphur;* and *Soda.*

What are the *symptoms* produced by a poisonous dose of these articles? Great heat in the throat, difficult and painful deglutition, vomiting of bloody matter, acute pain in the stomach, cold sweats, weakness, hiccough, colic pains, bloody stools, convulsions, and death: when nitrate of potash has been taken, there are also internal rigors. The carbonates will effervesce with acids, and the liver of sulphur will cause eructations of sulphuretted hydrogen.

What is the *treatment?* Vegetable acids, as vinegar, lemon-juice, &c., neutralize the alkalies and their carbonates: the fixed oils will form soaps with them, and destroy their caustic effects.

When nitrate of potash has been taken, an emetic should be given, and the effects should be combated by antiphlogistics. Common salt and liquid chloride of soda will decompose the liver of sulphur.

What are the *tests?* The alkalies are known by their action on turmeric paper; and by restoring the color of litmus, which has been reddened by an acid.

Carbonates by their effervescence with an acid; the muriate of ammonia by giving out fumes of ammonia when mixed with quick-lime.

Nitrate of potassa decrepitates, and deflagrates when thrown on hot coals.

Liver of sulphur emits sulphuretted hydrogen when dissolved with an acid.

EARTHS AND THEIR COMPOUNDS.

Baryta.

Carbonate, Muriate, and Nitrate.

What are the *symptoms?* Violent vomiting, burning in the stomach, purging, exhaustion, convulsions, and death.

What is the *treatment?* Dilute sulphuric acid and the soluble sulphates are antidotes, converting them into an insoluble sulphate of baryta. Emetics should also be given.

What are the *tests?* A soluble sulphate gives a white precipitate, insoluble in any of the acids.

Lime.

What are the *symptoms?* It is a pure irritant.

What is the proper *treatment?* Dilute acids or oils. It gives a precipitate with oxalic and carbonic acids.

Alcohol in all its Preparations.

What are the *symptoms?* Intoxication, complete insensibility, apoplexy, paralysis, swollen face, and a smell of liquor in the breath.

What is the *treatment?* Emetics, the stomach-pump, if the patient cannot swallow; the cold dash will answer a good purpose; and bloodletting, if necessary, should be resorted to. Acetate of ammonia *(spiritus Mindereri)* will relieve intoxication; and the inhalation of gaseous ammonia answers the same purpose.

Volatile Oils.

Creasote, Dippel's Animal Oil, Oil of Tar, Oil of Tobacco, Oil of Turpentine, Fusel Oil, &c.

What are the *symptoms?* Burning pain, vomiting, pungent taste, purging, &c Turpentine and tobacco affect the nervous system: the peculiar odor of each will serve to detect them in the matter vomited.

What is the *treatment?* Albumen for the creasote; dilute acids and fixed oils will counteract Dippel's animal oil: the others have no particular antidotes, but must be treated on general principles.

The odors of these substances afford the best tests.

Chlorine.

Gaseous.

What are the *symptoms* when inhaled? Violent irritation of the organs of respiration, bloody expectoration, inflammation, and permanent pulmonary disease.

What is the *treatment?* We have no antidotes. The effects to be treated on general principles. It is recognised by its bleaching property, and peculiar odor.

Iodine.

Iodide of Potassium.

What are the *symptoms?* Burning pain in the throat, lacerating pain in the stomach, fruitless efforts to vomit, suffusion of the eyes, and pain and tenderness of the epigastrium.

What is the *treatment?* Starch, or anything containing it, is the antidote for iodine. Iodide of potassium has no antidote, and our only reliance is in prompt emesis. Inflammation should be subdued by general treatment.

What are the *tests* for iodine? Starch forms a blue precipitate. Iodide of potassium gives a crystalline precipitate with tartaric acid, and the remaining liquid a blue color with starch.

Bromine.

What are the *symptoms?* Most violent burning pain in the fauces and stomach, with difficulty of breathing; which are soon followed by collapse and death. When applied externally, it has a corrosive action.

What is the *treatment?* Acetate of lead is the antidote; albumen or starch should be freely administered; and the inflammation is to be treated on general principles.

What are the *tests?* It is displaced from its compounds by chlorine, and is known by its color and odor.

METALS.

Antimony.

Tartar Emetic, Muriate or Butter of Antimony.

What are the *effects* as a poison? A severe metallic taste, nausea, copious vomiting, hiccough, burning pain in the stomach, colic, frequent stools and tenesmus, difficult respiration, fainting, small quick pulse, cold skin, loss of sense, cramps, prostration, and death.

What is the *treatment?* If emesis does not take place, it should be promoted by tickling the throat, and diluent drinks; antidotes

should be administered; among which are decoction of galls, Peruvian bark, common tea, &c. If the vomiting is excessive, give laudanum and warm brandy; and apply revulsives freely; the consecutive treatment should be adapted to the condition of the disease existing.

What are the *tests?* Sulphureted hydrogen forms an orange-colored precipitate with the solutions of antimony.

Free alkalies produce white precipitates. In its solid forms there are white fumes when heated, which redden litmus.

Arsenic.

Arsenious Acid, or White Arsenic. Orpiment, or Yellow Sulphuret of Arsenic. King's Yellow. Red Sulphuret. Fly Powder. Fowler's Solution. Arsenical Paste. Arsenical Soap. Arsenite of Copper, or Scheele's Green.

What are the *symptoms?* The different preparations are all violently poisonous, whether applied internally or externally. The symptoms are an austere taste, hawking, constriction of the throat, hiccough, nausea, anxiety, frequent sinkings, pain at the precordia, vomiting, black fetid stools, frequent irregular pulse, insatiable thirst, delirium, convulsions, loss of feeling, especially of the feet and hands, and death.

What are the usual *morbid appearances* after death? Inflammation of the mouth, stomach, and intestines; spots resembling eschars on the stomach and duodenum; perforations of their coats; and the villous coat of the stomach is reduced to the consistence of a reddish-brown pulp.

What is the *treatment?* Before the antidote can usually be procured, the poison should be dislodged by an emetic of sulphate of zinc or copper, tickling the throat, &c., or by the stomach-pump. Demulcents should be freely given, both before and after vomiting. As an antidote in all cases for the poisonous compounds of arsenic, the hydrated sesquioxide of iron, in a *moist* or *pulpy* state, should be given as soon as possible, in doses of a tablespoonful to an adult, of a dessertspoonful to children, every five or ten minutes, until urgent symptoms are relieved. The after symptoms should be combated on general principles.

The hydrated sesquioxide of iron is the antidote most commonly

relied on in cases of poisoning by arsenic; and the formula for its preparation is given below. Every apothecary and country physician should keep it always on hand.

HYDRATED PEROXIDE OF IRON.

℞.—Sulphuric acid (67° Baumé),	8 oz.	16 parts.
Iron wire,	8 oz.	16 "
Nitric acid (49° Baumé),	5½ oz.	11 "
Water of ammonia,	q. s.	
Water,	1¼ gal.	384 "

Mix the sulphuric acid with the water in a glass vessel; then add the iron; and after the effervescence has ceased, filter. Add the nitric acid in divided portions, and apply heat so long as orange-colored fumes are given off. To the heated solution, pour in the water of ammonia until a decided excess has been added; then wash the precipitate by decantation until the washings give no precipitate with nitrate of baryta. The water is then to be drawn off until just enough remains to give the consistence of thick cream. It should then be kept in bottles of convenient size for use, and given as above when required.

If the hydrate is not at hand, use the precipitated hydrate of magnesia or carbonate of iron, diffused through water in the same manner.

Calcined magnesia has also recently been used as an antidote with good effect. The hydrate of magnesia may be prepared by adding potassa to a solution of Epsom salts and washing the precipitate with water.

For the *tests* of arsenic, see Chemistry, article "Arsenic."

COPPER.

Sulphate of Copper. Acetate of Copper. Carbonate of Copper. Arsenite of Copper; and from Cooking Utensils, Soda Fountains, &c.

What are the *symptoms* of poisoning by the salts of copper? A coppery taste, pain in the head, nausea, vomiting, catharsis, colic, cramp, convulsions, insensibility, and death.

What is the *treatment?* Albumen, in the form of white of eggs, copious draughts of warm milk, and brown sugar, or molasses, are the best antidotes.

What are the *tests?* Ammonia gives a light blue precipitate, redissolved by an excess, forming a deep blue solution; ferrocyanate of potash, a rich claret red; sulphuretted hydrogen, a chocolate brown; and a polished needle causes a precipitate of pure copper on its surface.

Gold.

Chloride of Gold. Fulminating Gold.

What are the *symptoms?* Similar to other irritant poisons.

What are the *antidotes?* Magnesia and albumen; mucilaginous drinks should also be freely used.

What are the *tests?* The chloride is readily decomposed by the protosulphate of iron, and the nitrate of silver, and the gold separated in a metallic state.

Iron.

Sulphate and Chloride of Iron.

What are the *symptoms?* Irritating, colic pains, vomiting, purging, pain in the throat, tension of the epigastrium, coldness of skin, and feebleness of pulse.

What is the *treatment?* Carbonate of soda is a good antidote; and the particular symptoms should be relieved by their appropriate treatment. Albumen may be freely used.

Lead.

Acetate. Carbonate. Red Oxide. Litharge. Wines sweetened by Lead. From Cooking Utensils, &c.

What are the *symptoms?* Irritation of the alimentary canal, spasm, nervous symptoms, paralysis, either partial or complete, convulsions, and death. The most common effect is colica pictonum.

What is the *treatment?* The soluble sulphates, as magnesia, or soda; dilute sulphuric acid, which is also said to act as a preventive; and the phosphate of soda. Emetics of sulphate of zinc should also be used.

What are the *tests?* The soluble salts yield a white precipitate

with sulphates and carbonates in solution. The chromates and iodide of potassium give a yellow precipitate. Sulphuretted hydrogen a black.

MERCURY.

Corrosive Sublimate. Cyanuret of Mercury. Nitrate. Red Oxide. Sulphate. Red Sulphuret, and the White Precipitate.

What are the *symptoms?* An irritant; harsh, metallic, astringent taste; burning pain in the stomach; vomiting and purging of bloody matter; irritation of the urinary organs; tightness and burning in the throat; countenance pale or flushed; dozing, stupor, convulsions, and death.

What is the *treatment?* Albumen in some form or other, as eggs beaten up with water; milk; wheat flour beaten up with water. Carbonate of soda has been used with success in poisoning with corrosive sublimate. The inflammatory symptoms should receive their appropriate treatment.

What are the *tests?* Potash gives with corrosive sublimate a yellowish precipitate; ammonia a white; lime-water an orange; and sulphuretted hydrogen a black. A solution placed on gold, and touched with a knife, produces an amalgam of mercury and gold at the point touched. The nitrate gives a black precipitate with the free alkalies. All the solid forms of mercury are volatile, and they may also be reduced by heating them with charcoal and carbonate of soda, and the mercury will be sublimed.

SILVER.

Nitrate or Lunar Caustic.

What are the *symptoms?* The usual effects of the corrosive poisons.

What is the *treatment?* Common salt is the proper antidote. Mucilaginous drinks should be freely given, so as to produce vomiting. Consecutive inflammations should be treated according to the indications

What are the *tests?* Chloride of sodium gives a white precipitate, insoluble in nitric acid; ammonia, a gray precipitate, which

is redissolved by an excess of ammonia; and a yellow precipitate with phosphate of soda; the precipitates may also be reduced.

Tin.

Chloride of Tin. Solution used by Dyers. Oxide of Tin.

What are the proper *antidotes* for the salts of tin? Eggs or milk, in large quantities.

Zinc.

Oxide. Sulphate and Acetate of Zinc.

What are the *symptoms*? Violent vomiting; astringent taste; burning pain in the stomach; pale countenance; cold extremities; dull eyes; fluttering pulse. Death is a rare result.

What is the *treatment*? Warm water, carbonate of soda, milk, and albumen.

Phosphorus.

What are the *symptoms* of poisoning by phosphorus? The principal one is violent pain and irritation of the stomach.

What is the *treatment*? The stomach should be evacuated, and demulcents freely employed; but we have no antidote.

Glass, or Enamel.

What are the *symptoms*? When taken in coarse powder they produce irritation and inflammation of the bowels.

What is the *treatment*? A sulphate of zinc emetic, and demulcent drinks.

VEGETABLE POISONS.

How are the vegetable poisons divided? Into the *Irritant*, *Acro-narcotic*, and *Narcotic*.

Name some of the *Irritant* vegetable poisons.

Jalap, Scammony, Croton Tiglium, Spurge, Savin Oil, Red Cedar Oil, Elaterium, Poke, Cubebs, Ranunculi, Oleander, Castor Oil Plant, Gamboge, and *Tansy.*

What are the poisonous *effects* of these? An acrid pungent taste, with more or less bitterness, excessive heat, great dryness of the mouth and throat, with a sense of tightness; violent and continued vomiting; purging, with great pain in the stomach and bowels; pulse strong, frequent, and regular; breathing often quick and difficult; appearances of intoxication; dilatation of the pupil; insensibility resembling death; the pulse becomes slow and loses its force, and is followed by death. If applied externally, many of them vesicate and inflame the skin.

What is the *treatment?* If there is vomiting, use large draughts of warm water or thin gruel; but if other urgent symptoms come on without vomiting, it should be excited by sulphate of zinc, or some other prompt emetic; purging should also be excited when it does not exist. After the poison has been got rid of, give a strong infusion of coffee or dilute vinegar, camphor, or ether, and apply frictions; blisters may also be often used properly.

The other treatment should be upon general principles.

Acro-Narcotic Poisons.

Name some of them.

Aconite, Mushrooms, Truffles, Dogsbane, Arnica, Belladonna, Buckeye, Wormseed, Cicuta Maculata and Virosa, Cocculus Indicus, Colchicum, Conium, Stramonium, Digitalis, Ergot, Black Hellebore, Ipecacuanha, Camphor, Lobelia inflata, Oleander, Tobacco, Poison Vine or Rhus Rhadicans, Sumach or Poison Oak, Rue, Sanguinaria Canadensis, Squill, Pinkroot, Nux Vomica, Upas, Diseased Wheat, White Hellebore, Diseased Maize.

The inhalation of chloroform allays the spasms produced by nux vomica, or its active principle, strychnia.

Narcotic Poisons.

Name some of them.

Bitter Almonds and Peach Kernels, Hyoscyamus Niger and Albus, Lactuca Virosa, Opium and its proximate principles, Poppy, Cherry Laurel, Black Cherry, Wild Cherry, and *Dulcamara.*

What are the general *symptoms* of these poisons? Stupor,

numbness, heaviness of the head, desire to vomit, slight at first, but increasing; a sort of intoxication; stupid air; pupils dilated; furious delirium, sometimes pain; convulsions or palsy; pulse is variable, but at first generally strong and full; breathing quick, great anxiety and dejection, clammy skin, cold extremities, interrupted gasping respiration, and death unless relieved.

What is the *treatment?* Evacuation of the stomach by the pump, or an active emetic, of which sulphate of zinc is the best, and its action should be promoted by the usual means. After the stomach has been evacuated, dilute vinegar, stimulants, sinapisms, and frictions may be called for.

The patient should be bled if necessary; kept roused as much as possible by cold to the head, cold douche to the face and chest, and by the action of an electric or electro-magnetic machine, or flagellation; and artificial respiration should also be kept up, until the system can rally.

If opium produces difficulty of breathing, the inhalation of the vapor of water is attended with benefit; and spiritus Mindereri is said to prevent the stupor.

Poisonous Mushrooms.

There are five poisonous species.

What are the *symptoms?* Nausea, heat, pain in the stomach and bowels, with vomiting and purging; thirst; convulsions and faintings; pulse small and frequent; delirium; dilated pupils and stupor; cold sweats, and death.

What is the *treatment?* The stomach and bowels should be evacuated by an emetic, followed by a cathartic and stimulating clyster. After the poison is evacuated, ether may be administered with small quantities of brandy and water; but if inflammatory symptoms occur, they should be combated with appropriate remedies.

Animal Charcoal as an Antidote for Poisons.

This substance has recently been brought forward with consider able confidence, as an antidote for poisons, and particularly foi the whole class of vegetable poisons. The conclusions, which it is stated we are justified in admitting, are the following:—

1st. That animal charcoal has the power of withdrawing, when used at a proper temperature and in sufficient quantity, most, if not all, known vegetable and animal poisonous principles, and certain mineral poisons from their solutions.

2d. That, given at the *same time with, or shortly after* these poisons have been swallowed, it prevents their deleterious action, or acts an antidote.

3d. That, given in cases of poisoning, it can exert no injurious influence; but, on the other hand, promotes vomiting, entangles the poison, and protects the coats of the stomach against it.

4th. That, although it cannot be substituted for the usual antidotes for poisoning by mineral substances, yet it may be usefully employed in conjunction with them, or in their absence.

When given, it should be mixed with water as hot as can be swallowed, as its action is aided by an elevated temperature. Large quantities with warm water promote emesis.

Animal charcoal may be prepared by removing the earthy matter from ivory black by dilute chlorohydric acid, and afterwards washing and heating to redness in a covered crucible. This, however, is a tedious process, and only ten per cent. of pure charcoal is obtained. A better mode is to calcine leather scraps or blood with pearlash, washing and reheating in a close crucible. It is particularly necessary that a pure article should be used, and, as it may be kept for a long time without deteriorating, it should be prepared so as to be ready for use by apothecaries and country physicians. See *Ranking's Abstract*, No. 13, p. 302.

ANIMAL POISONS.

Poisonous Fish.

There are twenty or more species.

What are the *symptoms?* After eating, a weight at the stomach comes on, with slight vertigo, and headache, sense of heat about the head and eyes, thirst, often an eruption of the skin (urticaria), and in many cases death.

What is the *treatment?* An emetic, quickly followed by a purgative, should be given. Vinegar diluted may be drunk after their operation, and the body also sponged with it: sweetened water

and also alkaline water have been recommended to obviate the effects of the poison. If spasms occur after the evacuations, give laudanum; and if inflammation, adopt the appropriate treatment.

Poisonous Serpents.

Of these there are a number of species.

What are the *symptoms?* A sharp pain at the part bitten, which soon spreads over the limb or body; great swelling, at first hard and pale, then reddish, livid, and gangrenous in appearance; faintings, vomitings, convulsions, jaundice sometimes; pulse small, frequent, and irregular; breathing difficult, cold sweats; the sight fails, and the intellectual faculties are disordered. Inflammation, suppuration, and gangrene, followed by death.

What is the *treatment?* Excision of the part, if it can be done early; or destroyed by the application of caustic; apply a ligature, and cup the wound: aq. ammoniæ has been recommended as a local application to the wounded part, and also to be taken internally. The treatment should then be regulated by general principles. Keeping the patient intoxicated is sometimes attended with benefit.

Cantharis Vesicatoria.

Spanish or Blistering Fly; and Lytta Vittata, or Potato Fly.

What are the *symptoms?* A nauseous odor of the breath; acrid taste; burning heat in the throat, stomach, and abdomen; vomiting, often bloody, with copious bloody stools; severe pain in the stomach; painful and obstinate priapism, with heat in the bladder, and strangury or retention of urine; convulsions, delirium, and death.

What is the *treatment?* Vomiting should be excited by large draughts of sweet oil, sugar and water, milk or linseed tea, to which may be added ipecac. or sulphate of zinc. Emollient clysters; and if inflammation of the organs occurs, we use the appropriate remedies for such a condition. Camphor dissolved in oil may be rubbed over the belly and on the thighs.

Venomous Insects.

What are the *symptoms?* Usually there is not much swelling or pain; but at other times there are violent symptoms, intense pain, high fever and sickness.

What is the *treatment?* Hartshorn and oil rubbed on the part; salt and water is also a good application; they should be kept on until pain and swelling are reduced. Bathing the part with chloroform allays the pain.

Hartshorn or other diffusible stimulants internally are often necessary.

Saliva of the Rabid Dog.

What are the *symptoms?* At an uncertain period, pain occurs in the bitten part, although the wound may have healed. Anxiety, uneasiness, languor, spasms, great disturbance, and difficult respiration succeed; saliva flows from the mouth; there is a horror of drinks, and an inability to take them. These symptoms are all aggravated until death closes the scene

What is the *treatment?* No treatment can be relied on after the disease has occurred. As a preventive of the fatal symptoms, the part should be completely excised, even after it has healed, if not done before; the part should then be washed with warm water, caustic applied to it, followed by a poultice, and the wound healed by granulations.

PART V.

MATERIA MEDICA AND PHARMACY.

PART V.—MATERIA MEDICA AND PHARMACY.

WHAT is *Materia Medica?* It is that science which treats of medicines.

What is *Pharmacy?* It is the art of preparing them for use.

What is *Therapeutics?* Therapeutics comprises the principles of medicinal administration, and the indications which articles of the materia medica are calculated to fulfil.

What are *Medicines!* They are substances capable of producing as an ordinary result, and by their own inherent power, certain modifications of the vital functions, which render them applicable to the cure of disease.—*Wood.*

What are the objects of attention in the study of medicines? Their *origin; modes of collection* and *preparation; commercial history; sensible properties; chemical composition* and *relations; physiological action* and *toxological history; effects in diseases and the indications they are calculated to answer in their treatment; particular applications* in cases not falling under any general rule; and *doses, mode of administration,* and the *extemporaneous* or *officinal preparations* to which they may be subjected.

How may their operation be divided? Into their *primary* and *secondary* operation.

In what way may the primary or immediate influence of medicines be exerted?

1st. By *nervous communication.*

2d. By *entering* the *bloodvessels,* and acting through the medium of the circulation.

3d. By acting exclusively in the *neighborhood of their application.*

What are the methods of primary operation? *Mechanical* or *Physical; Chemical;* and *Physiological, Vital,* or *Dynamic.*

Have medicines in their operation an affinity for one part more than another? They have. Some substances act on the circulatory, nervous, or the absorbent system, and from the general distribution of these systems their action appears to be general. Others act upon the stomach, bowels, skin, kidneys, lungs, &c.; the primary action of which is considered to be local. This difference in their mode of action furnishes a basis for their division.

What influences affecting the system may modify the action of medicines? They are *disease, climate, mode of life, habit, age, sex, temperament, idiosyncrasies,* and *mental operations,* which should all be attended to in making prescriptions.

What general rule is applicable in the *doses* of medicines according to *age?* For children under twelve years of age the doses of most medicines should be diminished in the proportion of the age to the age increased by 12. Thus, at

2 years to 1-7; viz: $\frac{2}{2+12}$ =1-7: at 4 years, to 1-4, viz: $\frac{4}{4+12}$ =1-4. A full dose to be given at 21 years of age.—*Paris' Pharmacologia.*

Some medicines, such as castor oil, calomel, &c., may require larger proportional doses, and opiates smaller.

Disease, by modifying the susceptibility, often requires us to modify the quantity of medicine administered, to produce a given effect. The instances of this are numerous, and should be attended to in each particular case that may arise.

Climate, and also summer and winter in different climates, cause medicines to act differently. Narcotics act more powerfully in hot than in cold climates; therefore, smaller doses should be given; it is the reverse in regard to some other medicines.

Sex. Women require smaller doses than men; they are more rapidly affected by purgatives than men, and the condition of the uterine system should always be taken into account.

Temperament. Stimulants and purgatives more readily affect the sanguine than the phlegmatic; and, consequently, the dose should be modified.

Habits. A knowledge of these is important; persons habituated to the use of stimulants and narcotics, require larger doses to affect them when diseased; while persons in the habit of using saline purgatives require smaller doses of this class to operate on the bowels.

When opium is habitually used it requires larger doses of this article, but not of other narcotics.

Idiosyncrasies. These, of course, can only be known by experience with each particular individual and article of medicine; but, when known, it should govern us accordingly.

What is meant by the *secondary effects* of medicines? They are changes which follow the immediate operation of medicines, and depend upon certain physiological laws of the system, which modify the effects of primary actions and conditions, and are very important in the treatment of disease. Purgation is the primary operation of a cathartic, and derivation of blood from the head by depletion and revulsion is a secondary effect.

What are the *methods* by which their effects are produced? By the *depression following excitement;* by the *reaction following depression; through the dependence of function;* the *principle of sympathy* or *nervous transmission;* the *principle of revulsion* or *derivation;* the *efforts of Nature to repair injuries;* and the *removal of the cause.*

What are the *methods* by which the effects of medicines can be ascertained? *Through their sensible properties; their chemical relations; their botanical affinities; by experiment or observation on inferior animals;* and *by observation of their effects on man.*

What are the *methods* by which medicines operate in the cure of disease? By *depletion, repletion, dilution, elimination, stimulation, sedation, revulsion, supersession, alteration, anti-causation, chemical action,* and *mechanical action.—Wood.*

In what *forms* are medicines used? In *powders, pills, troches, extracts, electuaries, confections, mixtures, solutions, decoctions, infusions, wines, tinctures, vinegars, syrups, honeys, oxymels, liniments, cerates, ointments, plasters, cataplasms,* and *in the state of gas and vapor.*

Powders should be formed by drying the substance, bruising it in an iron mortar, and passing it through a sieve; and should be

kept in well-closed vessels. Medicines that are not very bulky or disagreeable, and that are not corrosive, are given in this way.

Pill is one of the most convenient forms of medicines, both for preservation and administration. In their preparation, the mass should be of a consistence to cohere properly, and yet firm enough to retain the globular form. Its composition should not permit it to mould, contract moisture, or harden too quickly and firmly. The *excipients*, or substances with which they are mixed, vary in some measure with the composition. Bread crumb, hard soap, extract of liquorice, mucilage, syrup, treacle, conserve of roses, &c., are the substances usually employed. If pills are to be kept some time, treacle and conserve of roses are best; if used early the others do well. When resins are used, the addition of alcohol prevents hardening. To prevent pills from adhering, use liquorice powder, flour, starch, or lycopodium. To cover them, gelatin answers well. Pills are best preserved in close bottles or tin boxes. The efficiency of small pills is greater than large ones, the same quantity of material being used. *Boluses* are preparations similar to pills, but larger.

Troches, or *Lozenges*, are often used; the basis consists of sugar, gum, or liquorice extract, which are combined with such articles of activity as may be desired. Care should be taken to avoid too great heat in preparing them.

Electuaries, *Confections*, and *Conserves*, are all essentially the same, and are in use as a vehicle or form for the administration of remedies which are bulky and insoluble, and can be disguised in taste by sweet substances.

Extracts consist of the active ingredients of complex medicinal substances, extracted by water, alcohol, or acetic acid, or by expressing the juice of plants and then evaporating to the solid consistence.

Mixtures, or *Emulsions*, are convenient modes of administration of remedies. They are generally composed of one or more substances which are insoluble, and suspended in water by the intervention of gum, sugar, or yolk of egg. Much care is necessary in forming a good mixture or emulsion, so as to be of a uniform character.

Decoction: this is a form much in vogue, but is improper when the substance contains a volatile oil, starch, or gum, unless these

latter are necessary for the purposes designed by the preparation. In some cases chemical changes also occur at the boiling point, by which the composition is entirely changed. The vessels used for decoctions should be covered, so as to prevent the escape of steam, and the process should be continued as short a time as suffices for extracting the desired material. Care should be taken that the vessel should be composed of a material not acted upon by the substance to be boiled.

Infusions are prepared either with cold or hot water, but are not boiled; and is a convenient mode of administering remedies of the vegetable kingdom. They are usually prepared as wanted, but may be kept some time, provided they be put into a bottle filled to the top and well corked. Many substances yield their active principles to cold water by *percolation* or *displacement*, which is becoming a favorite mode of obtaining them at the present time.

Tinctures are formed by macerating substances in alcohol or proof spirit for seven days or more, and then straining or filtering; or by *displacement* of the active ingredients by *percolation*, a method now generally preferred. This form is favorable to the preservation of the active constituents of drugs without alteration.

Syrups: where medicinal substances are preserved in a solution of sugar. Sometimes resorted to for the purpose of covering disagreeable taste, but more generally to preserve them in a convenient shape for making mixtures. They are *simple* or *radical;* the former consists of white sugar, 2½ ponnds to a pint of water; the latter are prepared by dissolving the sugar in a watery solution of the drugs, or by adding the tincture to simple syrup, and driving off the heat by a sand-bath. Heat should, however, be employed in all cases.

Vinegars is where vinegar is used as a solvent, and is often an eligible preparation.

Honeys are not now much in use.

Oxymels are where honey and vinegar is combined in preparation.

Liniments are oily compounds intended for external applications; they are softer than either cerates or ointments.

Ointments melt at the temperature of the surface of the body, but are harder than liniments and softer than cerates.

Cerates are harder than either liniments or ointments. *Simple*

cerate is composed of fresh lard and white wax. Some of these last preparations are made by simply mixing or triturating; others require the aid of a moderate heat, and agitation while cooling.

Plasters are solid at ordinary temperatures, and require the aid of heat to render them in a condition to be spread.

Cataplasms, or *Poultices:* these are preparations having properties of softness, or emollient properties, moisture, and heat or elevation of temperature in some cases. They are mostly prepared from bread and milk, flaxseed, slippery elm, &c.

Gas and Vapor: many articles may be applied to the surface of the body and lungs, or bronchial tubes, in this way, and affords a means of active medication in some cases.

To what *part* of the body are medicines applied? To the *stomach, rectum, skin, bronchial tubes* and *pulmonary air-cells, nostrils, inside of the mouth*, and by *injections into the blood-vessels.*

What are the *objects* in the application of medicines to the *rectum?* 1st. To produce alvine evacuations. 2d. To obtain their peculiar effects on the system, or on the rectum itself.

In the latter case it should be given in small bulk, so that it may remain in the bowels. The relative dose administered in this way should be three times the ordinary quantity, as a general rule. Medicines applied to the rectum are called *suppositories*, when solid; and, when liquid, *clysters, injections*, or *enemata.*

What are the *modes* of application to the *skin?* They are various. The skin may be retained or removed; the medicine may be used in the form of gas, vapor, liquid, or a soft solid, and may be applied to the whole surface of the body, or a part.

How are medicines applied to the *bronchial tubes*, &c.? In the state of gas and vapor.

What *objects* are to be gained by their application to the *nostrils?* A powerful excitement of the brain, and a strong revulsion from neighboring parts.

CLASSIFICATION.

Upon what principle is the preferable mode of classification founded? On the relations which medicines bear to the human system in a healthy state, or upon their physiological effects.

What is the first grand division in classification? Into medicines which act on the *living body*, and those which act upon *foreign matters* contained in the body.

How is the first grand division divided? Into those substances which act *generally*, and those which act *locally*.

How are the general remedies divided? Into *stimulants* or *excitants* and *sedatives*.

How are stimulants divided? Into *permanent* and *diffusible*.

How are the permanent stimulants divided? Into *astringents* and *tonics*.

How are the diffusible stimulants divided? Into *arterial stimulants* and *cerebro-nervous stimulants*.

The latter may be again divided into *cerebral stimulants* or *stimulant narcotics*, and into *nervous stimulants* or *anti-spasmodics*.

How are sedatives divided? Into *arterial sedatives* or *refrigerants*, and *nervous sedatives* or *sedative narcotics*.

How are the *local* remedies divided? Into those which affect the *functions*, those which affect the *organization*, and those which are *mechanical* in their action.

Those affecting the function of a part are: 1st. *Emetics*; 2d. *Cathartics*; 3d. *Diuretics*; 4th. *Diaphoretics*; 5th. *Expectorants*; 6th. *Emmenagogues*; 7th. *Sialagogues*; and, 8th. *Errhines*.

Those affecting the organization of a part are; 1st. *Rubefacients*; 2d. *Epispastics*; and 3d. *Escharotics*.

Those operating mechanically are: 1st. *Demulcents*; 2d. *Emollients*; and 3d. *Diluents*. Then there are *mercury, iodine, arsenic, nux vomica*, and *ergot*, which cannot be conveniently classified.

How is the second grand division divided? Into, 1st. *Antacids*; and, 2d. *Anthelmintics*.

TABULAR VIEW OF THE CLASSIFICATION,

AS ADOPTED BY PROFESSOR WOOD, OF THE UNIVERSITY OF PENNSYLVANIA.

I. *Substances which act on the living body.*

General Remedies.

Stimulants.

Permanent stimulants.

Astringents.
Tonics.
Diffusible stimulants.
Arterial stimulants.
Cerebro-nervous stimulants.
Cerebral stimulants, or stimulant narcotics.
Nervous stimulants, commonly called antispasmodics.

Sedatives.
Arterial sedatives, or refrigerants.
Nervous sedatives, or sedative narcotics.

Local Remedies.
Affecting the functions.
Emetics.
Cathartics.
Diuretics.
Diaphoretics.
Expectorants.
Emmenagogues.
Sialagogues.

Affecting the organization.
Rubefacients.
Epispastics.
Escharotics.

Operating mechanically.
Demulcents.
Emollients.
Diluents.

Medicines insusceptible of accurate classification.
Ergot.
Nux vomica.
Arsenic.
Mercury.
Iodine.

II. *Substances which act on foreign matters contained within the body.*

Antacids, Anthelmintics.

Astringents.

What is an astringent? A medicine which produces contraction of the living fibre.

What are the *general effects* of astringents? They produce greater firmness of muscle, diminished calibre, greater rigidity of the bloodvessels and absorbents, and a diminution or closure of secreting orifices and secretions generally. They produce moderate and permanent excitement of the organic life, but do not influence the nervous system much, or the functions of animal life

When are astringents *indicated*? In unhealthy discharges from the bloodvessels, or secreting orifices; in cases generally which depend upon relaxation of the tissues; and in inflammation in its earliest stage.

When are they *contra-indicated*? By the existence of any morbid condition of which the discharge is a mere effect, and which it is calculated to relieve; and by the existence of any considerable local or general excitement. In cases of excitement, if it be desirable to suppress a discharge, they should be preceded by bleeding, or other depleting measures. Their external use is governed with some modifications by the same rules, but may be admissible locally, when their internal use would not be justifiable.

In what *particular diseases*, attended with unhealthy discharges, are astringents applicable? Diarrhœa, chronic dysentery, diabetes, catarrh of the bladder, excessive sweating, and all the hemorrhages, always subject to the contra-indicating circumstances.

Under what *circumstances* may astringents be used locally in cases of inflammation? In the commencement of inflammation, before the excitability is much increased, or in the latter stages after it has become in some measure exhausted; and are applicable in increased mucous secretion, after the subsidence of inflammation, as from the urethra, vagina, rectum, and nostrils, in excessive perspiration, in hemorrhages from parts within reach; and in cases of local relaxation, as in venous distensions, prolapsed anus, uterus, and uvula, and in flabby ulcers.

How are astringents *divided*? Into the *vegetable* and *mineral*.

The former have an identity of character depending upon a

similarity of composition, the latter agreeing only in the property of astringency.

VEGETABLE ASTRINGENTS.

To what proximate principle do vegetable astringents owe their peculiar property? *Tannin*, or *tannic acid*, and *gallic acid;* and they differ only in the proportion of this principle, and in the character of the other ingredients associated with it.

What are the *sensible properties* of tannin? It is solid, uncrystallizable, white or slightly yellowish, strongly astringent without bitterness, and it precipitates many of the metallic salts, with iron forms a black compound, and is incompatible with gelatin, with which it forms a precipitate.

It is soluble in water, alcohol, and ether; reddens litmus, and forms salts with bases.

What is its *dose?* From 2 to 10 grs. every hour, 2, 3, or 4 hours.

Gallic acid is produced by an alteration of tannic acid by the addition of oxygen. It has been preferred to tannin by some as an astringent. The *dose* is the same as *tannin.*

QUERCUS, U. S.

What are the officinal species of Quercus in the United States, from which *oak bark* is derived? The *Quercus alba*, or white oak, and the *Quercus tinctoria*, or black oak, are the only ones officinal in the United States; but this genus contains about eighty species, thirty or forty of which are found in the United States.

They contain tannin and gallic acid; are powerfully astringent, and well adapted to cases requiring astringents, both internally and externally; although not used much internally.

The black oak contains a coloring principle, called *quercitrine*, which renders it valuable as a dye.

How is the oak bark used? In *powder*, *decoction*, and *extract.*

What is the *dose?* Of the powder, 30 grains; the decoction, f℥ij; extract, 20 grains.

Galla, *Galls*. U. S

What are Galls, and where are they *procured*. Excrescences on the young branches of the *Quercus infectoria* and other species, produced by the puncture of the *Cynips quercusfolii;* the best are gathered early, and are called *blue*, *green*, or *black* galls; the inferior are gathered later, and are called the *white* galls. Active principles, tannic and gallic acids.

They are brought from Asia Minor and neighboring countries.

How are galls generally *used?* As a local application externally, but may be used in *powder*, *infusion* or *decoction*, and *tincture*. Dose of the powder 10 to 20 grains; of the infusion (made ℥ss to Oj) f℥ij; of the tincture fʒss to fʒiij.

What are *incompatibles?* Sulphuric and muriatic acids, gelatin, preparations of iron, &c.

Kino, U. S.

What are the *varieties* of Kino? They are the *African*, *Jamaica*, *Botany Bay*, and *East India* or *Amboyna* kino. The East India is the kind most used, and is the inspissated juice of *Pterocarpus Marsupium*.

What are its general *characteristics?* As found in the shops, it is in small, irregular, angular, shining fragments, of a dark reddish-brown or black color, and easily pulverizable; contains tannin and extractive matter.

What are its *medical properties* and *uses?* It is powerfully astringent, and is one of the best articles of this class where astringents are indicated. It may be given in powder, infusion, or dissolved in diluted alcohol. *Dose of powder* from 5 to 30 grains; of *infusion* (made by ʒij extract, and boiling water ℔½) f℥j. The amount of alcohol in the tincture renders it objectionable. *Incompatibles* same as galls.

Catechu, U. S.

From what is the Catechu *procured?* It is an extract of the wood of the *Acacia Catechu*, and comes from Hindostan.

What are the *general characters* of catechu? It comes to us in masses of different shapes, of a rusty brown, varying from a reddish or yellowish-brown to a dark-liver color; contains tannin, extractive, and mucilage.

What are its *medical properties* and *uses?* It is tonic, powerfully astringent, and may be given where astringents are indicated. *Dose* from 10 grains to ʒss, and repeated frequently. *Incompatibles* same as galls.

RHATANY, *Krameria.* U. S.

From what is Rhatany *obtained?* From the root of the *Krameria triandria.* It is a native of Peru.

What are the *general characters* of rhatany? It comes to us in pieces of various shapes and dimensions, often cylindrical, and two or three feet in length. The mineral acids, and most of the mineral salts, are *incompatible.* Cold water, by displacement, extracts all the astringency from it.

What are its *medicinal properties* and *uses?* It is a gentle tonic, powerful astringent, and may be given where astringents are indicated. *Dose* of powder from 20 to 30 grains; of infusion or decoction (made by ℥j of bruised root to Oj of water) f℥j; of extract 15 or 20 grains; tincture fʒj to fʒiij; and syrup f℥ss.

LOGWOOD, *Hæmatoxylon.* U. S.

From what is the Logwood *procured?* From the *Hæmatoxylon Campechianum*, and is brought from Campeachy, the shores of Honduras Bay, and other parts of tropical America.

What are the *general characteristics* of logwood? It is hard, compact, heavy, of a deep-red color, becomes dark by exposure, and has a sweetish astringent taste. Its peculiar principles are *tannic acid* and *hæmatoxylin.*

What are its *medical properties* and *uses?* It is a mild astringent, well adapted to relaxed and enfeebled conditions of the bowels.

It is given in *decoction* and *extract*, both of which are officinal. *Dose* of the decoction f℥ij; of the extract 10 to 20 grains.

CRANESBILL, *Geranium*. U. S.

From what is the Cranesbill *derived?* From the *Geranium maculatum*, an indigenous, perennial, herbaceous plant, growing in

Fig. 1.

woods. The root is the part used, and should be collected in autumn; active principle, *tannin*.

What are its *medical properties* and *uses?* It is a powerful

astringent, and may be employed where they are indicated; it is very free from unpleasant qualities, which renders it serviceable for infants, and may be given in *substance*, *decoction*, *tincture*, or *extract*. *Dose* of powder 20 or 30 grains; decoction (made ℥j to Ojss boiled to Oj) from f℥j to f℥ij.

It is frequently given to children, boiled in milk.

Blackberry Root, *Rubus Villosus*. U. S.

Dewberry Root, *Rubus Trivialis*. U. S.

What is the officinal name of the plant furnishing the Blackberry Root and the Dewberry Root? The *Rubus Villosus* and *Rubus Trivialis*, the virtues of which reside in the bark of the root.

What are their *medicinal properties* and *uses?* Tonic and strongly astringent. The decoction is prepared the same as the preceding article, and given in the same dose. Dose of powder 20 to 30 grains.

Uva Ursi, *Arctostaphylos Uva Ursi*. U. S.

What is the plant furnishing the Uva Ursi? The *Arbutus Uva*

Fig. 2.

Ursi, or *Arctostaphylos Uva Ursi*, a small, trailing, evergreen shrub, growing plentifully in the United States as far south as New Jersey. The leaves are the part used.

What are the *general properties* of the leaves? They are inodorous when fresh, smell like hay when dried, have a bitterish taste, strongly astringent, and afterwards sweetish. The active ingredients are *tannin*, *bitter extractive*, *resin*, *gum*, and *gallic acid*.

What are its *medical properties* and *uses?* It is astringent,

Fig. 3.

tonic, and thought by some to have a specific direction to the urinary organs. *Dose* of *powder* is from ℈j to ʒj; *decoction*, ℥ij, 3 or 4 times a day.

Pipsissewa, *Chimaphila Umbellata.* U. S.

What portion of the Pipsissewa, or Chimaphila umbellata (Fig. 3), is used in medicine? The leaves and stem. It is a small, indigenous evergreen plant, growing in the north of Europe, Asia, and America; inhabiting the woods.

What are their *general properties?* The taste is pleasantly bitter, astringent, and sweetish. Boiling water and alcohol extract the native properties of the plant, which are tannin and bitter extractive.

What are its *medical properties* and *uses?* Diuretic, alterative, tonic, and astringent. It has been used with good effect in cases of scrofula. It is generally used in *decoction* (℥j to Ojss of water boiled to Oj), and taken in 24 hours.

Red Roses, *Rosa Gallica.* U. S.

What portion is used? The petals. It is a native of the south of Europe, but is introduced into the United States, and is extensively cultivated. The active principles are tannin, gallic acid, and coloring matter; not much used except in its preparations, as a vehicle for other articles.

Compound infusion is sometimes used when an astringent is required, but more frequently as a vehicle for sulphate of magnesia.

Conserve, formed with the petals, sugar, honey, and water; which is mostly used in the formation of pills.

Persimmon, *Diospyros Virginiana.* U. S.

What portion is used? The unripe fruit, in infusion, syrup, and vinous tincture; and the bark.

Creasote.

In what diseases has creasote been used as an astringent? In hæmoptysis and hæmatemesis; also in leucorrhœa and bronchor-

rhœa. It has also been used as a local application in hæmorrhage, and in a diluted state to relaxed inflamed surfaces; and to check vomiting in cholera, pregnancy, &c. *Dose*, as an astringent, one or two drops, several times a day, well diffused in mucilage. A fluidrachm contains 150 drops of creasote. Pill is said to be a good form of exhibition. One part to 80 of water is a good strength to begin with as a local application.

Several articles, as *wood-soot*, *pyroligneous acid*, *tar-water*, &c., owe their principle virtues to the presence of creasote in them.

MINERAL ASTRINGENTS.

ALUM, *Alumen*. U. S.

What is the chemical composition of Alum? It is a sulphate of alumina and potassa.

What are the *incompatibles*? The alkalies, lime, magnesia, and their carbonates; tartrate of potassa and acetate of lead.

What are its *medical properties* and *uses*? Astringent in ordinary medicinal doses, but emetic and purgative in large doses. It is used internally and locally. It forms an excellent local application to chronic congestive inflammations, and particularly in leucorrhœa. The ordinary dose is from 10 to 20 grains, repeated every two or three hours.

Alum curd is made by rubbing up alum with the white of an egg.

Alum whey; prepared by ʒij of alum in a pint of milk, and then straining. Dose ℥ij.

LEAD, *Plumbum*. U. S.

What are the preparations of Lead used medicinally? They are the *Litharge*, or *Plumbi Oxidum Semivitrium*, the *Carbonate*, the *Acetate* and *Subacetate*.

What are the *effects* of the combinations of lead? They are sedative and astringent, and produce poisonous effects, if taken in large doses, or long repeated. The sulphate, and probably the acetate, are exceptions to this. Sulphuric acid, sulphate of soda, and sulphate of magnesia are *antidotes*.

What are the *general properties* of the *Acetate of Lead?* It is a white salt, crystallized in brilliant needles. Its taste is sweet and astringent. It is liable to be decomposed by water containing carbonic acid, but is redissolved by acetic acid.

What are its *incompatibles?* It is decomposed by all acids, soluble salts, the acids of which produce insoluble or sparingly soluble compounds with the protoxide of lead, lime-water, ammonia, potassa, and soda. Sulphuretted hydrogen gives a black precipitate, and iodide of potassium a yellow one.

What are its *medical properties* and *uses?* In medicinal doses, it is powerfully astringent, sedative, and in large ones an irritant poison.

It is administered in hemorrhages of the lungs, intestines, and uterus. By giving acetic acid combined with it, the formation of a carbonate is prevented, upon which its poisonous qualities are supposed to depend.

Dose is from 1 to 3 grains, repeated as required.

What is the *white lead?* It is the carbonate; and is only employed externally, being used as an application to ulcers and excoriated surfaces. It is the most poisonous of the preparations of lead, producing the disease called *colica pictonum.*

What is *Goulard's extract of lead?* It is a *solution of the subacetate of lead* (Liquor Plumbi Subacetatis) formed by the acetate of lead ℥xvj, semivitrified oxide of lead ℥ixss, distilled water four pints, boiled and filtered; if diluted in the proportion of ʒij to a pint of water, it forms the *liquor plumbi subacetatis dilutus*, or *Goulard's vegeto-mineral water.*

Goulard's cerate is formed by heating together the extract with white wax, olive oil, and camphor.

The *nitrate of silver*, *sulphate of copper*, *tincture of chloride of iron*, *perchloride of iron*, *pernitrate of iron*, *sulphate of iron*, *sulphate of zinc*, and some other articles, are used for their local astringent effects, but they will be found under other heads, as they have other properties also besides that of astringency.

TONICS.

What are meant by Tonics? They are medicines which produce gentle and permanent excitement of the vital actions.

When are tonics *injurious?* In the healthy state, and in diseases of excitement.

They may diminish excitability, or natural healthy power; or, produce an irritation which may be followed by inflammation.

They should never be given in a state of sound health, with the view of increasing strength, or of rendering the system less accessible to disease.

Under what circumstances are tonics *indicated?* In cases in which the vital actions are depressed below the standard of health. They invigorate the system in a twofold manner: 1st, by increasing the energy of the stomach; and, 2d, by a direct influence over the whole frame, producing an elevation of all the vital actions.

They are also given for the purpose of making a decided impression on the nervous system, so as to break up diseases which occur in paroxysms with regularity.

There are several influences which may act as tonic *remedies* which are not medicines. These are *diet, exercise, pure air, mental influences, travelling, cold,* and *transfusion of blood.*

How may tonics be divided? Into the *pure bitters; bitters peculiar in their properties; aromatics;* and *mineral tonics.*

What are the effects of the *Pure Bitters?* They increase the appetite, invigorate digestion, have little influence over the circulation, unless in large doses, and exhibit but little evidence of action on the nervous system.

What are the effects of *Bitters peculiar in their properties?* They are generally more stimulating than the pure bitters.

What are the effects of the *Aromatics?* They depend upon the presence of volatile oil, are more stimulating than the bitters, and approach nearer to the diffusible stimulants.

What are the peculiarities of the *Mineral Tonics?* They have no common peculiarity except the tonic property, each having peculiarities which serve to distinguish it from the others.

PURE BITTERS.

Quassia, U. S.

From what is Quassia *derived?* It is the wood of the *Quassia excelsa* and *Quassia amara,* trees of the west Indies.

What are the *general characteristics* of quassia; The wood is whitish, and yellowish by exposure; has a purely bitter taste; the active principle is *quassin*.

What are its *medical properties* and *uses?* It has the properties of the simple bitters in their highest degree. It is particularly useful in dyspepsia from debility of the stomach. It is given in *infusion* in the proportion of ʒij to Oj cold water. *Dose* f℥ij, 3 or 4 times a day; of *extract*, from 2 to 5 grains; of *tincture*, fʒj to fʒij; of *powder*, 20 to 30 grains.

Goldthread, *Coptis*. U. S.

From what is the Goldthread *procured?* It is the root of the *Coptis trifolia*.

What are its *medical properties* and *uses?* It is a simple tonic

Fig. 4.

bitter, closely analogous to quassia. Dose of powder 10 to 30 grains; tincture fʒj.

Gentian, *Gentiana*. U. S.

From what is Gentian *procured?* It is the root of the *Gentiana lutea*, which grows on the Alps, and other mountains; the active principle of which is *gentianin*.

What are the *general properties* of the root? The taste is slightly sweetish, and intensely bitter. Water and alcohol extract the taste and medical virtues from it.

What are its *medical properties* and *uses?* It possesses in a high degree the tonic power of the simple bitters, excites the appetite, invigorates the power of digestion, increases the temperature of the body and the force of the circulation.

Fig. 5.

It is given in *powder*, *dose* 10 to 40 grains; in *infusion* (℥ss to Oj), f℥i to f℥ij; of *tincture*, fʒj to fʒij; of *extract*, 5 to 30 grains.

Sabbatia Angularis, U. S.

What portion of the *Sabbatia angularis*, or *American Centaury*, is used? The whole plant. It grows in the Middle and Southern States, in low meadows, and should be collected when in flower. It is prescribed in the same cases as gentian, and is generally given in infusion (℥j to Oj); in powder, the *dose* is ʒss to ʒj.

What are its *medical properties* and *uses?* It has the tonic properties of the simple bitters. *Dose* of the *infusion* (℥j to Oj) f℥ij.

Columbo, *Colomba*. U. S.

From what plant is the Columbo *derived?* The *Cocculus palmatus*. The root is the part used, and is brought from Africa.

What are its *general properties?* As it comes to us, it is in flat, circular, or oval pieces, of a bitter taste, and slightly aromatic odor. Active principle, *columbin*.

What are its *medical properties* and *uses?* It is a useful mild tonic, no astringency, and but slightly stimulant. Used in *powder*, *infusion*, and *tincture*. *Dose* of the *powder*, 10 to 30 grains; of *infusion* (made in the proportion of ℥ss to Oj), from f℥j to f℥ij; of *tincture*, fʒss to fʒj.

BITTERS OF PECULIAR, OR MODIFIED PROPERTIES.

PERUVIAN BARK, *Cinchona*. U. S.

From what is the Peruvian Bark *obtained?* Different species of the *Cinchona*, brought from the western coast of South America.

There are three officinal varieties: 1, *pale bark;* 2, *yellow bark;* and, 3, *red bark*.

The *pale* embraces the varieties called *Loxa* and *Lima;* the *yellow* is called in commerce *Calisaya* bark, and of which there are two varieties, the *quilled* and *flat*. The *red* is divided into the *quilled* and the *flat* also.

What are the important principles of bark? *Quinia, Cinchonia, Quinidia*, and *Quinoidia*, combined with *kinic acid*.

What preparations of bark are generally used? The *sulphate of quinia* and *cinchonia*.

What are the *medical properties* and *uses* of cinchona? It is one of the most valuable tonics we possess, as well as anti-intermittent. The best mode of giving the bark is in substance; *dose* of the powder ʒj.

What is the comparative power of sulphate of quinine compared with the bark? 10 to 14 grains is equivalent to ℥j of good bark. The different varieties of bark differ in the relative proportions of the active principles which they contain. The pale bark contains a much larger proportion of cinchonia than of quinia. The yellow bark contains a large proportion of quinia, with very little cinchonia. The red bark contains considerable quantities both of quinia and cinchonia. It is given as an *antiperiodic* in intermittents in *doses* of 12 to 18 grains, divided into two or three parts, in the interval of the paroxysm. As a mere *tonic*, $\frac{1}{4}$ to $\frac{1}{2}$ a grain 3 or 4 times a day. The sulphate of cinchonia requires to be given in somewhat larger quantity to produce the same results as the quinia.

The Peruvian bark or its preparations may meet several distinct therapeutical indications: 1, as a simple tonic; 2, as an antiperiodic; 3, as a supersedent; and 4, in reference to its secondary sedative properties.

DOGWOOD, *Cornus Florida.* U. S.

From what do we *procure* the Dogwood bark? From the

Fig. 5.

Cornus Florida, an indigenous tree. The *dose* and mode of using similar to the Peruvian bark.

Cerasus Serotina

WILD CHERRY BARK, *Prunus Virginiana.* U. S.

What is the officinal name of the tree from which the Wild Cherry bark is *procured*? *Prunus Virginiana*—indigenous to this country.

What are the active principles? *Hydrocyanic acid, tannin,* and *bitter extractive.*

What are its *medical properties* and *uses?* It is tonic and sedative; lessens the action of the heart and arteries; and is useful in the hectic fever of scrofula and consumption. *Dose* of *powder*, ʒss to ʒj; of the *infusion*, f℥ij 3 or 4 times a day.

Chamomile, *Anthemis Nobilis*. U. S.

What is the officinal name of the Chamomile? *Anthemis nobilis;* the flowers are the parts used, although all parts of the plant are active. The active principle is *bitter extractive* and *volatile oil*.

In small doses it is tonic, and in large ones emetic. The *cold infusion* is best when used as a tonic in doses of f℥ij; *dose* of the *powder*, ʒss to ʒj.

Boneset, *Eupatorium*. U. S.

What are the *medical properties* and *uses* of the *Eupatorium*

Fig. 1.

perfoliatum, or *Thoroughwort?* It is tonic, diaphoretic, and taken in large doses it acts as an emetic and aperient. As a tonic it should be administered in substance or cold infusion. *Dose* of the *powder*, 20 or 30 grains; and of the *infusion*, f℥i frequently repeated. As a diaphoretic, it should be given warm. As an emetic and cathartic, in doses of one or two gills of the strong decoction.

VIRGINIA SNAKEROOT, *Serpentaria*. U. S.

What are the *medical properties* and *uses* of the *Aristolochia Serpentaria*, or *Virginia Snakeroot?* It is indigenous; the root is the part used, and its active ingredients are a *bitter principle*

Fig. 8.

and *volatile oil.* It is a stimulant tonic, acting also as a diaphoretic or diuretic, according as it is administered.

Dose of the *powder,* 10 to 30 grains; *infusion,* f℥j to f℥ij every 2 or 3 hours; *officinal tincture,* fʒi to fʒij.

MYRRHA, *Myrrha.* U. S.

From what is Myrrh *procured?* It is an exudation from the *Amyris Myrrha.* There are two varieties, the India and Turkey.

What are its *medical properties* and *uses?* Its active principle is a *resin* and *volatile oil.* It is a stimulant tonic, with a tendency to the lungs, and also to the uterus. Employed in diseases of these organs where there is no febrile excitement or acute inflammation. *Used* in *powder* and *pill* in dose of 10 to 30 grains; of the *tincture,* fʒss to fʒj.

ANGUSTURA. U. S.

What are the *medical properties* and *uses* of the bark of the *Galipea officinalis,* or *Angustura?* Its active parts are *bitter extractive* and *volatile oil.* It is a stimulant tonic, but little employed in the United States.

Dose of the *powder,* 10 to 20 grains; *infusion,* f℥ij; *tincture,* fʒj to fʒij.

False Angustura bark has poisonous properties; its active ingredient is *brucia.*

CASCARILLA BARK, *Cascarilla.* U. S.

What are the *medical properties* and *uses* of the bark of the *Croton Eleutheria,* or *Cascarilla?* Its active ingredients are *extractive* and *volatile oil.* It is an aromatic tonic, and is now only employed where a gentle stimulant tonic is desired. *Dose* of the *powder,* 20 to 30 grains; of the *infusion,* f℥ij.

AROMATICS.

What are the *general properties* of aromatic tonics? They owe their characteristics to volatile oils, are more stimulant than tonics generally, and more local in their action than diffusible stimulants:

relieve pains in the stomach and bowels, expel flatulence, &c. Decoctions and extracts objectionable.

What are the *medical properties* and *uses* of ORANGE PEEL, or rind of the fruit of the *Citrus Aurantium?* It is a mild tonic, stomachic, and carminative; given in *infusion.*

What are the *properties* of the prepared bark of the *Laurus Cinnamomum,* or CINNAMON? There are two varieties, the *Ceylon cinnamon* and *China cinnamon,* or *cassia.* Its active principles are *volatile oil* and *tannin;* its medical use the same as aromatics in general, applicable in cases requiring astringents.

Dose of *powder,* 10 to 20 grains; *tincture,* f ʒj.

What are the *properties* of the bark of the CANELLA ALBA? Its active ingredients are *volatile oil* and *bitter extractive;* used generally combined with other articles. It is an ingredient in the powder of *Aloes and Canella,* or *hiera picra.*

From what are CLOVES *derived?* They are the unexpanded flower buds of the *Eugenia Caryophyllata,* or *Caryophyllus aromaticus;* brought from the West Indies and the European colonies of Guiana.

What are their *medical properties?* Their active principle is a *volatile oil.* They are used where a stimulant aromatic is indicated. *Dose* of the *powder,* 5 to 10 grains; *infusion* made with (ʒij to Oj) f ℥ij; *oil,* 2 to 5 drops. Used in several officinal preparations.

From what is the NUTMEG *procured?* It is the kernel of the fruit of the *Myristica Moschata,* growing in the Moluccas.

What are its *medical properties* and *uses?* The active principle is a *volatile oil;* it also yields a fixed oil, called the *Oil of Mace.* It combines narcotic with aromatic properties. *Dose* of *powder,* 5 to 10 grains; of *volatile oil,* 2 or 3 drops.

From what is the BLACK PEPPER *obtained?* It is the dried berries of the *Piper Nigrum.*

What are its *properties* and *uses?* It contains a volatile oil, an acid concrete oil, and *piperin.* Its activity depends upon its oils, and not the piperin, which is inert when pure. It is a warm carminative stimulant, and used where such properties are indicated.

From what are CUBEBS *obtained?* It is the dried fruit of the *Piper Cubeba,* a vine growing in the East Indies.

What are its *properties* and *uses?* Its active ingredient is a *volatile oil.*

It is aromatic and diuretic. *Dose* of the *powder*, ʒss to ʒiss 3 or 4 times a day; of the *volatile oil*, 10 to 20 drops.

From what is the PIMENTO *obtained?* The *Myrtus Pimento.* The active properties reside in a volatile and fixed oil. *Dose* of the *oil*, 3 to 6 drops.

What are the *properties* and *uses* of CARDAMOM, or the fruit of the *Alpinia Cardamomum?* It is a warm aromatic, less heating and stimulating than some others. It enters into a number of officinal preparations. *Dose* of the *compound tincture*, fʒj.

What other aromatic seeds are used in medicine? *Fennel, Caraway, Coriander, Anise.*

What is the *dose* of the *compound spirit of Lavender?* The dose is fʒss to fʒj.

What is the officinal name of the PEPPERMINT? *Mentha Piperita.* *Dose* of the *oil*, 1 to 3 drops; of the *essence*, 10 to 20 drops.

What is the officinal name of the SPEARMINT? *Mentha Viridis*, and possesses properties similar to the last.

Fig. 9.

What other herbaceous aromatics are used in medicine? The *Hedeoma pulegioides*, or PENNYROYAL; *Melissa officinalis*, or BALM; *Origanum vulgare*, or ORIGANUM; and the *Gaultheria procumbens*, or PARTRIDGE BERRY (Fig. 9).

From what is GINGER *procured?* It is the root of the *Zingiber officinale*, an herbaceous plant, native of the East Indies, and cultivated in the West Indies.

What are its *properties* and *uses?* It is aromatic, spicy, pun-

(Fig. 10.)

gent, hot, and biting. Its virtues are extracted by water and alcohol.

It is a grateful stimulant, and carminative; and may be given in *powder*, in doses of 10 to 30 grains; in *infusion*, f℥ij; in *tincture*, fʒj or fʒij.

In what doses is the Acorus Calamus, or *sweet flag* (Fig. 10) used? Its *uses*, *modes of administration*, and *doses* are similar to those of the ginger.

MINERAL TONICS.

Iron, *Ferrum*. U. S.

What are the *properties* of the preparations of iron? They are highly tonic, raise the pulse, promote the secretions, and increase the coloring matter of the blood. The diseases in which they are most used are chlorosis, hysteria, fluor albus, gleet, scrofula, rickets, &c.

The preparations of iron may be considered in reference to their *local effects* upon parts with which they come in contact, and their *effects on the system generally*. In their *therapeutic application* they may be considered as a *mere tonic*, or excitant of the functions, and as a *reconstructive agent*, by affording material and influence for the production of blood corpuscles.

What are the *doses* of the different preparations of Iron? The *Filings*—*Ramenta ferri*—in doses of 5 to 10 grains. *Scales*—*Squamæ ferri*—5 to 20 grains. *Prepared Carbonate*—*Ferri Carbonas Præparatus; Precipitated Carbonate*—*Ferri Carbonas Præcipitatus*. *Dose* of the last two, 5 to 20 grains; in neuralgic cases, from ʒss to ʒj, 3 times a day, and increased

Sulphate—*Ferri sulphas*—*Green vitriol*—*Copperas*—in *doses* of from 1 to 5 grains; of the dried, from ½ to 3 grains, 3 or 4 times a day.

What are the *incompatibles* of the sulphate? The alkalies and alkaline carbonates, muriate of lime and baryta; nitrate of silver; acetate of lead, tannin, &c.

Tincture of the Muriate—*Tinctura Ferri Muriatus*—dose 10 to 30 minims, 3 or 4 times a day. *Tartrate of Iron and Potassa*—*Ferri et Potassæ Tartras*—dose 10 to 30 grains. *Phosphate*, 5 to 10 grains.

Ammoniated Iron — Ferrum Ammoniacum — dose 10 or 12 grains. *Iodide of Iron — Ferri Iodidum* — dosc 2 or 3 grains, three times a day. *Syrup of Iodide of Iron*, or *Solution of Iodide of Iron* — dose 20 to 50 drops, threc times a day, diluted with water at the moment of exhibition. *Ferrocyanuret of Iron —Ferri Ferrocyanuretum—Ferrocyanide of Iron—Pure Prussian Blue*—dose 4 to 6 grains, several times a day.

Copper, *Cuprum*. U. S.

What is the effect of thc preparations of *Copper* on the system? In its pure state it is inert, but in combination highly poisonous; in small quantitics but little sensible effect is produced, except a slightly tonic and astringent influence.

When taken in poisonous doses, they produce a coppery taste in the mouth, nausea, vomiting, violent pain in the stomach and bowels, black and bloody stools, irregular pulse, faintings, thirst, difficulty of breathing, cramps, convulsions, and death. The best treatment in these cases is to administer white of eggs in water in large quantitics.

What are the *doses* of the different officinal preparations of Copper as a tonic? *Sulphate — Cupri Sulphas — Blue vitriol.* Dose $\frac{1}{4}$ of a grain, 2, 3, or 4 times a day, given in pill, and omitted if the stomach becomes irritated. *Ammoniated Copper—Cuprum Ammoniatum. Dose* $\frac{1}{2}$ a grain, three or four times a day.

Zinc, *Zincum*. U. S.

What are the preparations of Zinc used medicinally? The *Sulphate*, *Oxide*, *impure Oxide*, and *Carbonate*.

What are the *medical properties* and *uses* of the Sulphate of Zinc? It is tonic, astringent, and, in large doses, a prompt emetic. *Dose* as a tonic, $\frac{1}{2}$ a grain to 2 grains, two or three times a day; as an emetic, 10 to 30 grains.

What are the *incompatibles?* Alkalies and their carbonates, hydrosulphates, lime-water, and astringent vegetable infusions.

The *Acetate* and *Valerianate of Zinc* are used for the same purposes as the sulphate, but are rather milder and less astringent. The dose is the same.

30

The *Oxide* may be given in doses of 2 to 8 grains, which may gradually be increased to 20. It has been used externally in powder and ointment, as an absorbent, desiccant, and alterant.

BISMUTH, U. S.

What preparations of Bismuth are used medicinally? The *Subnitrate* or *White Oxide;* it is tonic and antispasmodic. *Dose* 3 to 30 grains, in powder or pill.

SILVER, *Argentum.* U. S.

What preparations of Silver are used medicinally? The *Nitrate, Oxide,* and *Chloride.*

What are the *medical properties* of the Nitrate of Silver? As an internal remedy, it is tonic, astringent and antispasmodic. It has been employed in epilepsy, chorea, angina pectoris, &c. Externally, it is a vesicant, stimulant, and escharotic. *Dose* $\frac{1}{4}$th of a grain, increased gradually to 4 or 5, three times a day, in pills. The proper *antidote* for a large dose is common salt.

What are its *incompatibles?* Its incompatibles are common salt, alkalies and their carbonates, lime-water, mineral acids, astringent vegetable infusions, &c.

What preparation of SULPHURIC ACID is used medicinally? The *Diluted* and the *Aromatic.* *Dose* of each, 10 to 30 drops. They increase the appetite and promote digestion.

What are its *incompatibles?* Its incompatibles are the alkalies, alkaline earths, their carbonates, &c.

What are the *effects* and *dose* of NITRIC ACID? It is tonic and refrigerant when diluted; concentrated, it is a corrosive poison. *Dose* 2 to 5 drops, in water.

What are its *incompatibles?* Its incompatibles are the alkalies, alkaline earths, their carbonates, sulphate of iron, the salts of lead, &c.

What is the *dose* of the NITROMURIATIC ACID? From 2 to 10 drops, 3 or 4 times a day.

ARTERIAL STIMULANTS.

What is understood by Arterial stimulants? They are medicines which excite the circulation, with but little influence on the nervous system.

Under what conditions of system are they applicable? In cases of great prostration, when sufficient energy of the system remains to sustain it at the point to which it may be elevated. Great care is often necessary in their use, even in some cases where they are indicated; or too great reaction may occur.

CAYENNE, OR RED PEPPER, *Capsicum.* U. S.

What are the *medical properties* and *uses* of the Cayenne Pepper, or Capsicum Annuum? It is a powerful stimulant, without being narcotic; useful in enfeebled and languid stomachs; active principle *capsicin*. *Dose* of *powder*, 5 to 10 grains; of *infusion* (ʒij to Oss), f℥ss; of *tincture*, fʒj to fʒij; used also as a gargle.

What are the *medical properties* and *uses* of SPIRITS OF TURPENTINE, OR OIL OF TURPENTINE? It is stimulant, diuretic, anthelmintic, and, in large doses, cathartic. *Dose* 5 to 20 drops, repeated.

What is the *dose* of PHOSPHORUS? It is $\frac{1}{12}$th of a grain, in an oleaginous, or ethereal solution.

What are the properties and dose of CARBONATE OF AMMONIA? It is stimulant, diaphoretic, and antispasmodic. The *dose* as a stimulant is from 5 to 10 grains, in pills or emulsion, and repeated. It is one of our best stimulants in low fevers, &c.

NERVOUS STIMULANTS, OR ANTISPASMODICS.

What is understood by Nervous Stimulants? They are medicines that not only affect the heart and arteries, but also superadd an excitant influence over the nervous system.

Under what conditions of the system are they applicable? In deranged conditions of the nervous system, not connected with inflammation or arterial excitement, and particularly if associated with general debility. They are termed antispasmodics from their

power of relieving spasm, when it is the result of irregular distribution of nervous influence dependent upon debility, or other cause not connected with inflammation. They are useful in morbid vigilance, restlessness, dejection of mind, hypochondriasis, and sometimes in mental derangement.

From what is MUSK obtained? It is obtained from the *Moschus Moschiferus*, an animal resembling the deer, found in Asia.

What are its *medical properties* and *uses?* It is stimulant and antispasmodic, and used in cases where these qualities are indicated, particularly in low states of the system. Given in pill and emulsion. *Dose* 10 grains, and increased.

How is *artificial musk* prepared? By the action of nitric acid on amber.

From what is CASTOR obtained? It is a peculiar product of the Castor fiber, or Beaver. It is not much used. *Dose* in *substance*, 10 to 20 grains; in *tincture*, f ʒj to f ʒij.

ASSAFŒTIDA. U. S.

From what is Assafœtida *procured?* It is the inspissated juice of the root of the *Narthex Assafœtida.*

What are its *medical properties* and *uses?* Its active part is a *resin* and *volatile oil.* It is a moderate stimulant, powerful antispasmodic, an expectorant, and feebly laxative. *Dose* 5 to 20 grains, in pill; *emulsion (Lac assafœtida),* f ℥ss to f ℥j; of the *tincture*, f ʒj.

VALERIAN, *Valeriana.* U. S.

From what is Valerian *obtained?* It is the root of the *Valeriana officinalis*, a native of Europe.

What are its *medical properties* and *uses?* It is a gentle stimulant, with a narcotic effect. It is used in hysteria, hypochondriasis, &c. Active principles a *volatile oil* and *volatile acid*, called *valerianic.*

Dose of the *powder*, 30 to 90 grains; of the *infusion* (℥j to Oj), f ℥ij; of the *tincture*, fʒj to fʒiv; of the *oil*, 4 to 6 drops; of the *fluid extract*, ʒj to ʒiij.

What are the *properties* and *uses* of the OIL OF AMBER? It is

stimulant and antispasmodic, and used as a liniment. *Dose* 5 to 10 drops, in emulsion.

What other nervous stimulants do we possess? *Garlic, Tea, Coffee, Skunk Cabbage,* &c.

CEREBRAL STIMULANTS.

CALLED ALSO NARCOTICS, FROM THE STUPOR WHICH THEY PRODUCE IN LARGE DOSES.

What is understood by Cerebral Stimulants? They are medicines which not only stimulate the circulation, but also conjoin a peculiar determination to the brain. They are also called *narcotics*, from the stupor they occasion in large doses. When taken in sufficient doses to destroy life, it is occasioned by the suspension of respiration, consequent upon impaired cerebral influence. Their influence is rapidly diminished by habit, and must, therefore, be rapidly increased in dose to keep up any required effect, provided their long-continued use becomes necessary. Caution is always necessary in their use. These are called *narcotics*, from the stupor they occasion; *anodynes*, from their influence in relieving pain; and *soporifics*, or *hypnotics*, from their effect in inducing sleep.

ALCOHOL.

How is Alcohol *produced?* By the *vinous fermentation.*

What are its *medical properties* and *uses?* It is a powerful stimulant, and is the intoxicating ingredient in all *spirituous* and *vinous* liquors. It is not used in medicine in a pure state; diluted, it is extensively used as a menstruum.

When a decided stimulus is required, *brandy* is preferred; but, when a more moderate one, *malt liquors* or *wine* is used.

What WINES are used medicinally? *Madeira, Teneriffe,* and *Sherry; Port* when an astringent is indicated.

Wine-whey is a convenient and good form of giving wine; it may be made by adding to a pint of boiling milk half a pint of whatever wine may be preferred; separate the curd from the whey, and flavor to suit the taste if wished.

Malt liquors possess tonic, alterative, and nutritious properties,

and may be used more freely than wine. *Porter* and *Ale* are said to be the best.

When the pulse becomes fuller and slower, the skin moist, and delirium abates under the use of alcoholic remedies, the influence is favorable.

How is SULPHURIC ETHER procured? By the distillation of alcohol and sulphuric acid.

What are its *medical properties* and *uses?* It is a transient, powerful diffusible stimulant; and given where such medicines are indicated. *Dose* f ℨss to f ℨj.

OPIUM. U. S.

From what is Opium *obtained?* It is the concrete juice of the *Papaver somniferum*, or *Poppy.*

Of what is it composed? *Morphia, narcotina, codeia, meconic, acid, gum, extractive, resin,* &c.

What are its *incompatibles?* All vegetable infusions containing tannin and the alkalies.

What are its *medical properties* and *uses?* It is a stimulant narcotic. It diminishes the peristaltic action of the bowels, and all the secretions except of the skin; allays inordinate muscular contractions, and general nervous irritation. Medium *dose* in *substance* is 1 grain; of the *tincture*, 25 drops; of the *camphorated tincture*, fℨi; f ℥j of which contains 2 grains of opium; of the *acetated tincture*, 20 drops, which is equal to one grain of opium; of the *sulphate, acetate*, and *muriate of morphia*, $\frac{1}{6}$th of a grain is equal to 1 grain of opium.

The best *tests* for the presence of morphia are the *sesquichloride of iron*, which causes a *blue* color; and *nitric acid*, which produces a *blood-red* color.

From what is LACTUCARIUM procured? It is the inspissated milky juice of the *Lactuca sativa.* *Dose* 2 to 3 grains.

CANNABIS INDICA, *Hemp of India.*

From what is *Extractum Cannabis*, or *Extract of Hemp*, obtained? It is an alcoholic extract of the dried flowering tops of the *Cannabis sativa*, grown in the East Indies. The active principles of this plant are a *volatile oil*, and a peculiar resin called *Cannabin.*

What are its *medical properties* and *uses?* It slightly increases the force of the pulse, acts with energy upon the brain, exalting, deranging, and finally diminishing the functions of the cerebral centres, and produces mental confusion. The *indications* for its use are to allay pain, relieve spasm and other nervous disorders, and to promote sleep. It is said also to have the property of producing uterine contractions. It is used in *extract* and *tincture.* The dose of the former, when of best quality, is ½ grain, repeated every two or three hours until its effects are produced. In tetanus it is given in ten grain doses, and repeated every hour until its effects are manifest. Forty drops of the tincture are equal to 1 grain of extract.

HENBANE, *Hyoscyamus.* U. S.

From what is Henbane *procured?* From the *Hyoscyamus Niger.* Leaves and seeds officinal.

Fig. 11.

What are its *properties* and *uses?* Its active principle is *hyoscyamin*, or *hyoscyamia*. It is narcotic in large doses; in small ones it gently accelerates the circulation, and increases the general warmth; it does not constipate.

Dose, of *leaves*, 5 to 10 grains; of *extract*, which is mostly used, 2 or 3 grains; of *tincture*, f℈j.

Hops, *Humulus*. U. S.

From what are Hops *procured?* They are the strobiles of the *Humulus Lupulus*.

The active principles are a *volatile oil* and a *peculiar bitter principle*.

What is *Lupulin?* It is a yellowish powder, obtained separate by rubbing and sifting the strobiles. Its bitter principle is called *lupulite*, or *lupuline*.

What are their *medical properties* and *uses?* Tonic, moderately narcotic, and used in diseases of debility where morbid vigilance exists.

Dose of the *infusion* of hops (made with ℥ss to Oj of water) is f℥ij; of the *tincture*, f℈i to f℥ss; of the *lupulin*, 6 to 12 grains, in pill; of the *tincture*, f℈j to f℈ij.

Camphor, *Camphora*. U. S.

From what is Camphor *derived?* From the *Laurus Camphora*, an evergreen, growing in China and Japan? It is procured by sublimation from the roots and smaller branches.

What are its *properties* and *uses?* It is very volatile, and may be sublimed unchanged. The medium *dose* is 1 to 10 grains in emulsion. In each ounce of the *aq. camphora*, when well made, there is 3 grains of camphor. It enters into the composition of several liniments.

Deadly Nightshade, *Belladonna*. U. S.

What is the active principle of *Atropa Belladonna*, or Deadly Nightshade? An alkaline principle called *atropia*.

The leaves of the plant are the part used. *Dose* of the *powdered*

leaves 1 grain, night and morning; of the *infusion* (℈j to ℥x of water) f℥j to f℥ij; of the *extract*, which is the inspissated juice, $\frac{1}{4}$ to $\frac{1}{2}$ a grain, twice a day, and increased if necessary. It is used in the form of plaster, and as an application to the eye and the os uteri.

THORNAPPLE, *Stramonium*. U. S.

What part of the *Datura Stramonium*, or Thornapple, is used

Fig. 12.

medicinally? The leaves and the seeds. The active alkaline principle is *daturia*.

What are its *medical properties* and *uses*? It is a powerful narcotic, and sometimes used in epilepsy. *Dose*, of the *seeds*, 1 grain; of the *extract* from seeds, $\frac{1}{4}$ to $\frac{1}{2}$ a grain; of the *powdered leaves*, 2 to 3 grains; of the *tincture*, 10 to 30 drops; of the *extract* of the leaves, 1 grain. Used also as an *ointment*.

BITTERSWEET, *Dulcamara*. U. S.

What is the *dose* of the Dulcamara, or Bittersweet? Of the officinal *decoction*, f℥ij, 4 times a day; of *extract*, 5 to 10 grains. Active principle, *solania*.

HEMLOCK, *Conium*. U. S.

What is the *dose* of the *Conium maculatum*, or Hemlock? Of

Fig. 13.

the *powdered leaves*, 3 or 4 grains; of the *extract*, or inspissated juice of the leaves, 3 grains; *tincture* ʒss to ʒj.

ARTERIAL SEDATIVES.

What is meant by Sedatives? Medicines which, by their immediate influence produce a reduction of the vital actions.

Arterial sedatives are those that operate more particularly upon the heart and arteries, independent of depletion. Those that reduce both arterial and nervous power are called nervous sedatives.

Under what circumstances are arterial sedatives indicated? In increased vascular action, arising from an increased display of the vital energies. *Refrigerant* remedies belong to this class.

Antimony.

What preparations of Antimony are employed medicinally? The *tartar emetic, precipitated sulphuret,* and *antimonial powder.*

What are the *properties* and *uses* of *Tartar Emetic,* or the *Tartrate of Antimony and Potassa?* It is the most important of the antimonials. Its general action is sedative on the circulation, while it excites many of the secretions. It may produce an alterative, diaphoretic, diuretic, expectorant, purgative, and emetic effect, according as it is administered. Applied externally it acts as a counter-irritant.

Its *dose,* as an *alterative,* is from $\frac{1}{32}$d to $\frac{1}{12}$th of a grain; as a *diaphoretic,* or *expectorant,* from $\frac{1}{12}$th to $\frac{1}{6}$th of a grain; as a *nauseating sudorific,* from $\frac{1}{4}$ to $\frac{1}{2}$ a grain, repeated as occasion requires; as a *purgative,* $\frac{1}{6}$th of a grain combined with Epsom salts ʒj, and repeated every two or three hours; as an *emetic,* from 2 to 4 grains given in divided portions, at intervals of 10 or 15 minutes.

The antimonial wine contains 2 grains of tartar emetic to f℥j.

What are its *incompatibles?* Mineral acids, the alkalies and their carbonates, sulphurets, lime-water, and vegetable astringents.

What is the *dose* of the *Precipitated Sulphuret?* As an alterative 1 to 2 grains; as an emeto-cathartic 5 to 20 grains.

What is the *dose* of the *Antimonial Powder,* used in imitation of *James' powder?* From 3 to 8 grains.

What other medicines are used as arterial sedatives? Nearly all the *neutral alkaline salts,* and those in which the acid predominates; they are usually called refrigerants, the most prominent of which is *nitrate of potassa. Dose* 5 to 10 grains every hour or two, in powder or solution. It is frequently combined with tartar emetic.

The *Vegetable acids* are also refrigerant or arterial sedatives.

NERVOUS SEDATIVES.

What is understood by Nervous Sedatives? They are remedies that reduce the nervous powers as well as the force of the circulation. They all affect the functions of the brain, and rank with those medicines usually called *narcotics.*

To what class of diseases are nervous sedatives applicable? To complaints attended with nervous disorder, and unhealthy excitement of the heart and arteries.

Foxglove, *Digitalis*. U. S.

What are the *medicinal properties* and *uses* of the leaves of the *Digitalis purpurea*, or *Foxglove?* They are narcotic, sedative, and diuretic. Active principle *digitalin*, the dose of which is $\frac{1}{66}$th of a grain.

It is best given in *substance*. *Dose* 1 grain twice or three times a day; of the officinal *infusion* (ʒj to Oss), f℥ss; of the *tincture*, 10 drops, which is equivalent to 1 grain of the substance. It requires caution in its exhibition.

Lobelia. U. S.

Furnished by the *lobelia inflata*, which grows abundantly in the United States. The whole herb is officinal, but the seeds are the strongest portion, and should be gathered in August and September. Active principle, *Lobelina*. The *dose*, as a nervous sedative and nauseant, is 5 grains in *powder*, repeated every hour or two; *tincture*, for the same object, fʒj.

Aconite.

The officinal article is the *Aconitum Napellus*, growing in the mountainous districts of Central Europe. The leaves and root are the parts used. Active principle, *aconitin* or *aconitia*.

It is locally irritant, followed by numbness, and generally sedative to the nervous system and the circulation. It is a powerful poison in large doses. It has been used to fulfil the indications of reducing morbid excitement of the nervous or circulatory systems.

It is used in *powder* of the leaves in doses of 1 or 2 grains; *alcoholic extract* of the leaves, $\frac{1}{2}$ grain to 1 grain; of the extract of the root, $\frac{1}{4}$ of a grain; *tincture* of the leaves 20 drops; *tincture* of the root 3 to 5 drops, three times a day, and increased gradually

It may be applied locally freely for the purpose of relieving local pains; caution should be observed in applying it to mucous membranes and to abraded surfaces The aconitia may be made into an ointment, and applied locally also.

AMERICAN HELLEBORE, *Veratrum Viride.* U. S.

The *rhizome* of the *veratrum viride*, which grows in the United States from Maine to Georgia. It is locally irritant, and in its general action it is powerfully sedative to the nervous system and circulation, and stimulates the secretions. It is also emetic in its effects. Its excessive action may be controlled by opiates and alcoholic stimulants. It has been used chiefly in inflammations, fevers and nervous diseases.

It is used in *powder*, dose 1 or 2 grains, every three or four hours; *extract* (made by drying the expressed juice of the root at a low temperature), $\frac{1}{4}$ to $\frac{1}{2}$ grain; *tincture* (℥viij of dried root to a pint of officinal alcohol, by Dr. Norwood, macerated two weeks), 4 to 8 drops, repeated every three or four hours, if necessary, to produce the desired effects.

In what preparations is the HYDROCYANIC or PRUSSIC ACID found? In the *Cherry Laurel water*, and in the *Oil of Bitter Almonds.*

What are its *properties* and *uses?* It is a deadly poison; one or two drops of the pure acid is sufficient to prove fatal. The medicinal article is diluted, and may be given in does of from 1 to 6, or 8 drops in distilled water, gum water, or syrup. It should be administered with caution, commencing with the smallest dose. The *antidotes* are chlorine, ammonia, cold affusion, and artificial respiration.

What is the active principle of the *Nicotiana tabacum*, or TOBACCO? *Nicotia*, or *Nicotin.*

What is the quantity given as an injection? Infusion, made of ʒss to Oss at a time.

EMETICS.

What are Emetics? Medicines capable of producing vomiting in certain doses, and as an ordinary result.

What are the *therapeutical effects* of emetics? Evacuation of the stomach, mechanical pressure on the abdominal viscera, reduction of arterial action during the period of nausea, muscular relaxation, promotion of the secretory functions of the skin, liver, and lungs, powerful agitation of the whole frame, purgation frequently,

revulsion to the stomach, depletion, promotion of absorption, shock on the system, and irritation of the stomach.

What are the circumstances *contraindicating* the use of emetics? Acute inflammation of the stomach, bowels, or neighboring viscera; strong sanguineous determination to the brain; and pregnancy in the advanced stages. Caution should also be observed in cases of hernia.

How are emetics usually *administered?* Diffused in water, in doses repeated every 15 or 20 minutes until vomiting occurs. When the object is merely to evacuate the stomach, warm diluent drinks should be freely given, chamomile tea is very good; if we wish a powerful impression made on the system but little drink should be allowed. If vomiting should be excessive, apply a sinapism over the epigastrium, and laudanum internally, which will generally relieve it: a laudanum injection is also beneficial.

Ipecacuanha, U. S.

From what is Ipecacuanha *obtained?* It is the root of the *Cephælis Ipecacuanha*, growing in South America.

What are its *properties* and *uses?* In large doses it is emetic; in smaller, diaphoretic and expectorant; in still smaller, stimulant to the stomach, promoting its healthy actions. Its active principle is *emetia.* It is mild, and certain in its operation. *Dose* as an *emetic*, 15 to 30 grains; as a *nauseant*, 2 to 3 grains; as a *diaphoretic*, $\frac{1}{2}$ to 2 grains; as an *alterative*, $\frac{1}{2}$ grain, repeated 2, 3, or 4 times a day.

The *Wine of Ipecacuanha* is emetic in doses of f℥j to an adult, and fʒj to an infant. *Emetic*, $\frac{1}{2}$ grain; *syrup*, about double the quantity of the wine.

What is the dose of the root of the *Gillenia trifoliata, Indian physic*, or *American Ipecacuanha?* From 20 to 30 grains.

Lobelia, U. S. (Fig. 14.)

What are the *properties* and *uses* of the *Lobelia inflata*, or *Indian Tobacco?* Besides emetic, diaphoretic, and expectorant properties, it has sedative properties. The whole plant is active. It bears a close resemblance in its effects to tobacco. It is too

powerful and distressing, as well as hazardous in its operation, for ordinary use. *Dose* of the *powder* from 5 to 20 grains, as an emetic; of the *tincture*, f ʒj to f ʒij every two or three hours until it acts.

Fig. 14.

MILK-WEED, *Euphorbia Corollata.* U. S. (Fig. 15.)

Where does the Euphorbia grow? In various parts of the United States. The dried root is emetic in *doses* of from 10 to 15 grains.

What other vegetable substances possess the property of pro-

ducing vomiting, and are occasionally used for that purpose? The root of the *Euphorbia Ipecacuanha*, in *doses* of from 10 to 20 grains.

Fig. 15.

Bloodroot, *Sanguinaria*. U. S. (Fig. 16.)

The root or rhizome of the *Sanguinaria Canadensis;* active ingredient, *sanguinaria*. *Dose* of the *powder*, from 10 to 20 grains; of the *tincture*, fʒiij to ℥ss. An acrid emetic.

The Squill; in *dose* of 6 or 8 grains.

Tobacco; *dose* of the *powder*, 5 or 6 grains.

Mustard in powder; *dose* ʒj.

What is the *character* of Tartar Emetic as an emetic? It is characterized by certainty, strength, and permanency of operation. It remains in the stomach longer than ipecacuanha, and exerts a more powerful impression on the system generally.

Dose, 2 to 4 grains, given in divided portions; 1 grain with 10 of ipecacuanha, repeated if necessary, makes a good emetic; of the

Fig. 16.

wine f℥ss to f℥i, repeated if necessary; for a child of 1 or 2 years old, 20 to 40 drops.

What are the *characteristics* of the SULPHATE OF ZINC as an emetic? It is characterized by promptness and comparatively little nausea. Used chiefly as a mere evacuant of the stomach in cases requiring a prompt and energetic emetic; as in narcotic

poisons, when it should be combined with ipecacuanha. *Dose*, 10 grains to ʒss.

What are the *characteristics* of the Sulphate of Copper as an emetic? It is characterized by promptness and slight nausea, more prompt and powerful than the last article. Seldom used except in narcotic poisoning, where it is given in doses of 5 to 15 grains.

Alum has been used as a very certain emetic in membranous croup, in doses of one teaspoonful of the powder every fifteen minutes, until it operates.

CATHARTICS.

What are Cathartics? They are medicines which produce evacuations from the bowels. They operate: 1. By irritating the mucous membrane of the bowels; 2. By stimulating the exhalant vessels and mucous follicles; 3. By stimulating the liver; and, 4. By absorption. Some act one way and some another, and some by a combined action.

Do they operate on all parts of the alimentary canal alike? No; some operate on one portion, and some on another, and others on the whole.

What is meant by a *hydragogue cathartic?* A cathartic which produces large watery evacuations.

How are cathartics divided? Into *laxatives*, *purges*, and *drastics* or *drastic purges*.

In what way are cathartics useful in disease? They evacuate the bowels and relieve constipation; they directly deplete from the bloodvessels; promote absorption; act as revulsives; and some by increasing the secretions from the liver, and thereby relieving congestion.

Is the action of cathartics modified by combination? It is; by mixing several drastics together they become milder without loss of purgative power. Small doses of emetic substances promote their operation; the same effect is also produced by bitters. Their tendency to gripe may be lessened by aromatics.

What circumstances affect the operation of cathartics? They operate more favorably and speedily when given on an empty stomach. Susceptibility to their action is diminished during sleep and increased by exercise. Mild diluent beverages, such as molasses

and water, barley or rice-water, oatmeal gruel, &c., form proper drinks to be taken before and during the operation of a cathartic. Excessive or *hypercatharsis* may be checked by a few drops of laudanum.

VEGETABLE CATHARTICS.

MANNA, U. S.

From what is Manna procured? It is the concrete juice of the *Ornus Europea* and *rotundifolia*, growing in the south of Europe. There are three varieties: *flake*, *common*, and *fat manna*.

The *first*, or *flake*, is the result of spontaneous exudation; the *common* is produced when the season is more advanced, by incisions; the *fat* is obtained still later in the season; they are to be preferred in the order named.

What are its *medical properties* and *uses?* It is a gentle laxative. *Dose* ℥j to ℥ij. Active principle, *mannite*.

PURGING CASSIA, *Cassia Fistula.* U. S.

What are the *properties* and *uses* of the *Cassia Fistula* or *Purging Cassia?* The pulp of the pods is the medicinal portion. It is gently laxative, and given in cases of habitual costiveness. It is an ingredient in the confection of senna.

Dose ℥ss to ℥j.

CASTOR OIL, *Oleum Ricini.* U. S.

What plant produces the Castor Oil? The *Ricinus Communis*, a native of Africa, but cultivated in Europe and in this country. The oil is obtained from the seeds by expression.

What are its *medical properties* and *uses?* It is a mild cathartic, speedy in its action, and good to remove accumulation of feces in the bowels.

Dose for an adult f℥j; children requiring more in proportion than adults.

RHUBARB, *Rheum.* U. S.

From what is Rhubarb *obtained?* It is the root of different

species of *Rheum;* of which we get three varieties: the *Russian*, *Chinese*, and *European.* The Chinese is the most used, but the Russian is the best. The active principles are *rhubarbarin* and tannin.

What are its *medical properties* and *uses?* It combines a cathartic and astringent power; it is tonic and stomachic in small doses; roasting increases its astringent, and decreases its purgative effects. *Dose* as a stomachic and laxative 5 to 10 grains, as a purgative 20 to 30 grains; of the European variety the dose should be double. There are numerous officinal preparations of rhubarb.

Infusum Rhei (ʒi to Oss), dose f℥i to f℥ij; *Pilulæ Rhei* (Rhei ʒij, sapon. ʒij, div. in pil.); *Pilulæ Rhei Comp.* (Rhei ℥i, Aloes ʒvi, Myrrh ʒss, Ol. Menth. Pip. fʒss, Syrup. Aurant. q. s. div. in pil.); *Syrup. Rhei Arom.* (Rhei ℥iss, Caryophyll., Cinnam., āā ℥ss, Myristic. ʒij, Alcohol, diluted, Oij, Syrup Ovi), or *Spiced Syrup of Rhubarb; Tinctura Rhei* (Rhei ℥iij, Cardam. ℥ss, Alcohol, diluted, Oij); *Tinctura Rhei et Aloes* (Rhei ʒx, Aloes ʒvi, Cardam. ℥ss, Alcohol Oij), or *Elixir Sacrum; Tinctura Rhei et Sennæ*, or *Warner's Gout Cordial; Fluid Extract of Rhubarb* (Rhubarb ℥viij, Sugar ℥v, Tinct. Ginger f℥ss, Ol. Fennel, Ol. Anise, āā., ♏iv, Diluted Alcohol q. s). Dose fʒj to f℥ss.

SENNA, U. S.

From what is Senna *obtained?* It is the leaves of several species of *Cassia.* There are three commercial varieties—*Alexandria*, *Tripoli*, and *India Senna.*

What are its *properties* and *uses?* It is a prompt, efficient, and safe purgative.

Its active principle is *cathartin.* *Dose* of the *powder* ʒj; generally given in *infusion*, which is officinal ℥j to Oj, and given in doses fʒii every 4 or 5 hours. The *elixir salutis* is a tincture of Senna and Jalap. *Dose* fʒij to f℥ss. Its tendency to gripe may be obviated by aromatics.

Fluid Extract of Senna (Senna ℔iiss, Sugar ℥xx, Ol. Fennel fʒi, Comp. Spt. Ether fʒij, Diluted Alcohol Oiv.) *Dose* ℥ss to ℥i.

Dose of *Confection of Senna* ʒj to ℥ss.

AMERICAN SENNA, *Cassia Marilandica.* U. S.

What are the *properties* and *dose* of the Cassia Marilandica, or

Fig. 17.

American Senna? It is similar in properties to senna, but weaker; dose one-third greater.

BUTTERNUT, *Juglans.* U. S.

What are the *properties* and *uses* of the *extract* of the Juglans

cinerea? It is a mild cathartic, operating without pain, and evacuating the alimentary canal without debilitating.

Dose 20 to 30 grains as a purgative, and 10 or 12 grains as a laxative.

Aloes, U. S.

From what is Aloes *procured?* It is the inspissated juice of different species of *Aloe*.

There are three commercial varieties — *Cape*, *Socotrine*, and *Hepatic Aloes*.

What are its *properties* and *uses?* It is cathartic, operating slowly, but certainly, and has a peculiar affinity for the large intestines.

It also has a tendency to the uterine system. *Dose* as a laxative from 2 to 6 grains; as a purgative 10 to 15 grains. It is usually given in *pill*. There is a large number of officinal preparations of aloes.

Pilulæ Aloes et Assafœtida (Aloes, Assafœtida, Saponis, āā). *Pilulæ Aloes* (Aloes, Saponis, āā). *Pilulæ Aloes et Myrrhæ* (Aloes ℥ij, Myrrh ℥j, Croci ℥ss, Syrup q. s.), or *Rufus' Pills*. *Pulv. Aloes et Canella* (Aloes ℔j, Canella, ℥iij), or *Hiera Picra*, or *Holy Bitter*. *Tinctura Aloes et Myrrhæ* (Aloes ʒiij, Tr. Myrrh Oij), or *Elix. Proprietatis*.

Jalap, *Jalapa*. U. S. (Fig. 18.)

From what is Jalap *obtained?* It is the root of the *Ipomœa Jalapa*, or *Ipomœa purga*, a vine, native of Mexico.

What are its *properties* and *uses?* It is an active cathartic, operating briskly, and sometimes with pain, producing copious watery stools. *Pulv. Jalapæ Comp.* (Jalap ℥i, Potassa Bitart. ℥ij.)

Dose of the *powder*, 15 to 30 grains; of the *resin of jalap*, 8 to 10 grains; of the *extract*, 10 to 20 grains.

May-Apple, *Podophyllum Peltatum*. U. S. (Fig. 19.)

What are the *properties* and *uses* of the *Podophyllum peltatum?* It is an active, certain cathartic, produces copious liquid discharges

Fig. 18.

without much griping, or other unpleasant effect. It resembles jalap in its operation, and is applicable whenever a brisk cathartic is required. The *dose* of the powdered root is about 20 grains.

It contains a resinous principle, obtained by Mr. Hodgson, of Philadelphia, called *podophyllin*, which gives the peculiar property to the root, mainly, the dose of which is about 2 grains.

Scammony, *Scammonium*. U. S.

From what is Scammony *obtained?* It is the inspissated juice of the *Convolvulus Scammonia*, growing in Siberia and Asia Minor. There are two varieties in commerce, the *Aleppo* and *Smyrna* Scammony.

What are the *medical properties* and *uses* of scammony? It is an energetic cathartic, apt to occasion griping, and may be used in cases where a powerful impression is desired. It is seldom given alone. *Dose*, 5 to 10 grains.

Fig. 19.

BLACK HELLEBORE, *Helleborus.* U. S.

What are the *properties* and *uses* of the root of the *Helleborus niger*, or Black Hellebore? It is a drastic hydragogue cathartic, with emmenagogue powers; the fresh root applied to the skin will inflame and vesicate. *Dose*, 10 to 20 grains.

It is seldom given alone. It is sometimes called *Melampodium.*

COLOCYNTH, *Colocynthis.* U. S.

From what is Colocynth *procured?* It is the fruit of the *Cucumis Colocynthis*, deprived of its rind. It is an annual plant, bear

ing considerable resemblance to the common cucumber; and is a native of Turkey.

Fig. 20.

What are its *medical properties* and *uses?* The pulp is a powerful, drastic, hydragogue cathartic, producing all the effects of cathartics of this class. The dose is 5 to 10 grains. The active principle is *colocynthin.* It is seldom given alone. The most common form of its exhibition is the *compound extract* (Colocynth ℥vi, Aloes ℥xii, Cardamom ℥i, Saponis ℥iij, Alcohol, dilut., cong.), which is officinal. *Dose,* 10 to 15 grains.

GAMBOGE, *Gambogia.* U. S.

What is Gamboge? It is the inspissated juice of a tree supposed to be *Stalagmitis Cambogioides,* or *Garcinea Cambogia,* natives of Asia.

What are its *properties* and *uses?* It is a powerful, drastic, hydragogue cathartic; apt to nauseate and vomit, and used in cases

where such properties are indicated. *Dose*, 3 to 6 grains in *pill* or *emulsion.* It is a constituent in the *compound cathartic pill* (Ext. Colocynth. Comp. ℥ss, Ext. Jalap., Hydrarg. Chlor. Mit., āā ʒiij, Gamboge ℈ij), the dose of which is 3 pills.

Elaterium, U. S.

What is Elaterium produced from? The *Momordica Elate-*

Fig. 21.

rium, or *Squirting Cucumber*, a native of Europe. The fruit has the shape of a small oval cucumber, about $1\frac{1}{2}$ inches long, covered with stiff hair or prickles. The elaterium is the substance spontaneously deposited by the juice of the fruit, resides in that part which surrounds the seeds, and may be obtained without expression.

What are its *properties* and *uses?* It is a powerful hydragogue cathartic, and, in large doses, will excite vomiting.

The *dose* of ordinary commercial elaterium is from 1 to 2 grains, given in $\frac{1}{4}$ grain portions, repeated every half hour or hour until it operates. Of the purest (Clutterbuck's) $\frac{1}{8}$ of a grain is a dose. The active principle is *elaterin.* *Dose*, $\frac{1}{16}$ of a grain.

Croton Oil, *Oleum Tiglii.* U. S.

From what is the Croton Oil *procured?* It is the oil of the

Fig. 22.

seeds of the *Croton Tiglium*, a native of the East Indies; obtained by expression of the seeds after having been deprived of their shell.

What are its *properties* and *uses?* It is a powerful hydragogue purgative, producing violent effects if given in an overdose. *Dose*, 1 or 2 drops, administered in *pill* with a crumb of bread. Ap-

plied externally, it inflames the skin, and produces a pustular eruption.

MINERAL CATHARTICS.

SULPHUR.

What are the *properties* and *uses* of *Flowers of Sulphur?* It is laxative, diaphoretic, and alterative, is evidently absorbed, and passes off by the skin. *Dose*, as a laxative, ʒj to ʒij. It is used externally as an ointment, and in vapor.

How is *Lac Sulphuris* prepared? By boiling sulphur and lime in water, filtering, precipitating by muriatic acid, and washing the precipitate.

MAGNESIA, U. S.

What are the *properties* and *uses* of the *Carbonate of Magnesia?* It is antacid, and by combining with acid in the stomach becomes cathartic. *Dose*, ʒss to ℥ij.

What are the *properties* of *Calcined Magnesia*, or *Magnesia usta?* It is antacid and laxative; used very much among children. *Dose* for an adult, ʒj; for a child two years old, from 10 to 20 grains.

SALINE CATHARTICS.

What is the general character of Saline Cathartics? They are intermediate in power between laxatives and purgatives, produce watery evacuations, operate as arterial sedatives, and do not act harshly. These properties adapt them to inflammatory and active febrile complaints. They closely resemble each other in properties.

What are their *doses?* SULPHATE OF SODA, or *Glauber's salt;* of the crystallized salt, ℥j to ℥ij; effloresced, half the quantity.

SULPHATE OF MAGNESIA, or *Epsom salts; dose*, ℥j to ℥jss.

SULPHATE OF POTASSA; *dose*, ℥ss to ℥jss.

SUPERTARTRATE OF POTASSA, called also *cream of tartar; dose*, ℥ss to ℥j. It is frequently combined with jalap as a hydragogue.

TARTRATE OF POTASSA, or, *soluble tartar; dose*, ℥ss to ℥j.

TARTRATE OF POTASSA and SODA, or *Rochelle salt; dose*, ℥j to ℥jss. It enters into the composition of the *Seidlitz Powders*, which are tartrate of potassa and soda ʒij, and bicarbonate of soda

℈ij, in a white paper; and tartaric acid, grs. xxxv, in a blue paper.

Phosphate of Soda; *dose*, ℥j to ℥ij.

Citrate of Magnesia, *magnesian lemonade* (Acid. Citric. ʒss, Magnes. Carb. ℈j, Syrup. Aurant. fʒij, Aq. destil. f℥ij). Effervescing solution of Citrate of Magnesia (Acid. Citric. ʒss, Aq. destil. f℥j, Syrup. Aurant. fʒij); to be taken with fʒx of Dinneford's solution of bicarbonate of magnesia in effervescence.

What is the officinal name of Calomel? *Mild Chloride of Mercury—Hydrargyri Chloridum Mite—Hydrargyri Chloridum—Protochloride of Mercury—Subchloride of Mercury*—sometimes improperly called *Submuriate of Mercury.*

What are the *tests* of *purity?* It sublimes freely on the application of heat, and strikes a black color, free from reddish tinge, by the action of fixed alkalies. The presence of corrosive sublimate may be tested by ammonia.

What are its *incompatibles?* The alkalies, alkaline earths and their carbonates, soluble hydrosulphates, &c. Nitromuriatic acid probably converts it into corrosive sublimate, and may thus render it very poisonous, also the alkaline chloride, and should, therefore, never be given with it.

Howard's calomel is prepared by bringing steam in contact with it while in a state of vapor, which converts it into an impalpable powder, and washes it from corrosive sublimate.

What are the *medical properties* and *uses* of calomel? In addition to the general properties of mercurials, it unites those of a purgative and anthelmintic.

It is employed to a great extent, and is the most valuable of the mercurial preparations.

As a *cathartic*, its tendency to increase the secretory functions of the liver is its chief value.

As an *alterative*, the dose is ½ a grain every other night, or every night, keeping the bowels at the same time gently open. To produce *salivation*, the dose is ½ to 1 grain, 3 or 4 times a day, increased if necessary. If it purges, it should be combined with opium; as a *purgative*, the dose is 5 to 15 or 20 grains. Larger doses are required in proportion for children than adults.

Calomel is frequently combined with other purgatives. It is also frequently employed topically in powder, ointment, and fumigation.

ENEMATA.

For what purposes are Enemata employed? To hasten, facilitate, or increase the action of cathartics, to operate on the bowels where medicines cannot be properly used or retained by the stomach, where there is too great a debility to sustain the action of a purgative, or there is great feculant accumulation in the lower bowels, and in habitual constipation; also to obtain the peculiar local or general effects of medicinal articles on the body. A solution of common salt, molasses, and lard, combined, is in common use; warm water alone, or soap and water, also form very good injections. If a more powerful remedy is required, castor oil and oil of turpentine, common salt, or senna tea, are very proper. An emulsion of spirits of turpentine and also of assafœtida are often used in tympanitic conditions of the bowels. When the peculiar effects of remedies are wished, articles adapted to the case should be selected, and administered in some convenient vehicle, such as starch-water or flaxseed tea; and the bulk should be small, so that they may be retained. They are a valuable class of remedies.

DIURETICS.

What are Diuretics? They are medicines which increase the secretion of urine.

How do they operate? In one or more of three ways—by entering the circulation, by a sympathetic impression, or by promoting absorption.

What *therapeutic effects* may be accomplished by the use of diuretics? They diminish the quantity of liquid in the circulation; produce absorption; purify the blood of excrementitious material; impart to the urine the power of dissolving a larger quantity of saline matter thrown off by the kidneys, and rendering it less irritant; and the lining membrane of the kidneys may also be stimulated when debilitated or paralyzed. They are, therefore, used in *dropsy, febrile* and *inflammatory diseases*, and in *diseases of the kidneys* and *urinary organs*.

SQUILL, *Scilla* U. S.

From what is the Squill *obtained?* It is the bulb of the *Scilla*

maritima, growing on the borders of the Mediterranean. Its active principles are called *scillitin*, and an *acrid substance*.

What are its *medical properties* and *uses?* It is diuretic, expectorant, and, in large doses, emetic and purgative. As a diuretic, it is generally combined with calomel, and used when there is not much inflammatory action existing. *Dose* as a *diuretic* or *expectorant*, 1 to 2 grains, repeated every 2 or 3 hours, and increased in quantity until its action is evinced. As an *emetic*, from 6 to 12 grains.

Meadow Saffron, *Colchicum*. U. S.

What are the *properties* and *uses* of the bulb and seeds of the *Colchicum autumnale*, or *Meadow Saffron?* They produce sedative effects upon the nervous system as well as stimulate the secretions. Given in sufficient doses, they produce disorder of the stomach and bowels, vomiting and purging severely, and should, therefore, be given with some caution. When not carried off by the bowels, diuresis and diaphoresis are produced. They are used in rheumatism and gout *Dose* of the bulb, or seeds, from 2 to 8 grains; but it is usually administered in the form of *wine*. Active principle, *colchicia*.

There are two officinal *vinous tinctures*.

The *Vinum Colchici Radicis*, the *dose* of which is from 10 drops to f℥j.

The *Vinum Colchici Seminis*. *Dose*, f℥ss to f℥j.

Dandelion, *Taraxacum*. U. S.

What are the *properties* and *uses* of the *Leontodon Taraxacum*, or *Dandelion?* It is slightly diuretic, tonic and aperient; and is thought to have a specific action on the liver. Its properties adapt it to diseases of the digestive organs, and dropsical affections depending upon them. An irritable condition of the stomach and bowels, and acute inflammation, contra-indicate its use. *Dose*, of the officinal *decoction*, f℥ij 2 or 3 times a day; of the *extract*, 20 or 30 grains.

Fig. 23.

JUNIPER BERRIES, *Juniperus*. U. S.

What are the *properties* and *uses* of the fruit of the *Juniperus communis*, or *Juniper Berries?* The active ingredient is a *volatile oil.*

The berries are stimulant and diuretic, and, in large doses, produce irritation of the urinary passages; they are generally used as an adjuvant to more powerful diuretics. It is a native of Europe. *Dose*, of the *infusion* (℥j to Oj), one pint during the day, often combined with cream of tartar; of the *oil*, 5 to 15 drops.

WILD CARROT, *Carota*. U. S.

What are the *properties* and *uses* of the seeds of the *Daucus Carota*, or *Wild Carrot?* They are gently stimulant and diuretic, and may be used in nephritic affections where the stomach is enfeebled. The active ingredient is a volatile oil. *Dose*, ʒss to ʒj of the *bruised seeds;* or one pint of the *infusion*, made with ℥jss to Oj of water, in the 24 hours.

PARSLEY ROOT, *Petroselinum*. U. S.

What are the *properties* and *uses* of the root of the *Apium Petroselinum*, or *Parsley?* It is diuretic and aperient; used in strangury. *Dose* of the *infusion* indefinite.

Turpentine, *Terebinthina.* U. S.

From what is turpentine *obtained?* It is the juice of different species of the genera *Pinus Abies* and *Larix,* and consists of a *resin* and *volatile oil.*

There are two kinds used in the United States. The common *white turpentine,* derived principally from the *Pinus palustris;* and the *Canada turpentine,* derived from the *Abies balsamifera,* or *Balsam of fir.* Their virtues reside in the volatile oil.

What are their *medical properties* and *uses?* They are stimulant, diuretic, anthelmintic, and laxative. If long continued, they produce irritation of the mucous membrane of the urinary organs. *Dose,* 10 grains to ʒj, in pill or emulsion.

The *volatile oil,* or *spirit of turpentine,* is generally used, the *dose* of which is 10 to 20 drops, and repeated It is also used externally as a rubefacient.

Buchu. U. S.

This consists of the leaves of several small shrnbs of Southern Africa, of the genus *Barosma* Their virtues depend principally upon a volatile oil, and partly on a bitter principle. It is stimulant, tonic, and diuretic. It is used in cases of debility with chronic inflammation of the pelvis, of the kidney, ureters, bladder, and urcthra, attended with profuse discharges of mucous or mucopurulent matter.

The *dose* of the *powder* is 20 or 30 grains, two or three times a day; *infusion* (℥j to Oj of water), f℥j to f℥ij; *tincture,* fʒj to fʒiv; *fluid extract,* fʒj.

Copaiva, *Copaiba.* U. S.

From what is the Balsam of Copaiva *derived?* It is the juice of the *Copaifera officinalis,* and other species of the *Copaifera,* growing in Brazil and Guiana.

What are its *properties* and *uses?* Its constituents are a resin and a volatile oil. It is gently stimulant, diuretic, and laxative.

It is used in gonorrhœa, leucorrhœa, gleet, chronic dysentery, and in chronic bronchitis. *Dose,* 10 to 30 drops, 3 times a day; of the *volatile oil,* 5 to 15 drops.

Tar, *Pix Liquida.* U. S

What is tar? It is an empyreumatic product, and consists of resin held in solution by acetic acid and an empyreumatic oil; colored by carbonaceous matter; slightly soluble in water. Used in *aqueous solution (tar water)*, *wine*, and *vapor*. In *ointment*, it is useful in many cutaneous affections. *Creasote* is an active ingredient in it.

Cantharides, *Cantharis.* U. S.

What are the *medical properties* and *uses* of *Cantharis vesicatoria, Cantharides*, or *Spanish flies?* Administered internally, they are powerfully stimulant, and exercise a peculiar influence over the urinary organs. In moderate doses, diuretic. Externally applied, they inflame and vesicate. *Dose*, 1 or 2 grains of the *powder* 2 or 3 times daily; of the *tincture*, 10 drops as often.

What are the doses of the Carbonates of Potassa? The carbonate is used in doses of 10 to 30 grains 3 or 4 times a day.

The bicarbonate is used in doses of from ʒss to ʒj.

What are the *medical properties* and *uses* of the Acetate of Potassa, or Sal Diureticus? It is *diuretic* in doses of from ℈j to ʒj, every 2 or 3 hours. In large doses, it is *cathartic*.

What are the *properties* of Bitartrate of Potassa, or Cream of Tartar? It is diuretic, cathartic, and refrigerant. In small doses, it is a cooling aperient; in large ones, it is a hydragogue cathartic, which renders it useful in dropsies, as well as on account of its diuretic properties.

The *dose* is from ʒj to ʒij as an *aperient;* and from ℥ss to ℥j as a *hydragogue cathartic.*

What are the *medical properties* and *uses* of the Nitrate of Potassa, or *Saltpetre?* It is diuretic, refrigerant, and diaphoretic.

Dose, as a *diuretic*, from 10 to 20 grains, repeated.

What are the *medical properties* and *uses* of Spirit of Nitric Ether, or *Sweet Spirit of Nitre?* It is diuretic, diaphoretic, and antispasmodic.

Dose, in febrile diseases as a *diaphoretic*, about 1 teaspoonful. When given as a *diuretic*, it should be given in larger doses.

DIAPHORETICS

What are Diaphoretics? They are medicines which promote perspiration.

How do they exert a beneficial effect in disease? By removing constriction of the cutaneous capillaries; by depleting from the bloodvessels; by revulsion to the surface; by promoting absorption; and by eliminating noxious matter from the blood.

What circumstances should a patient be subjected to if free perspiration be required? He should be confined in bed, well covered, clothed with flannel next the skin, and warm diluent drinks freely given. If there is high inflammatory excitement, the lancet or other depleting remedies should be premised.

How are diaphoretics divided? Into *nauseating*, *refrigerant*, and *alterative diaphoretics*.

NAUSEATING DIAPHORETICS

What are some of the Nauseating Diaphoretics? IPECACUANHA, and TARTRATE OF ANTIMONY and POTASSA.

With what is ipecacuanha usually combined? With opium in the form of *Dover's Powder*, which consists of ipecacuanha 1 grain, opium 1 grain, and sulphate of potassa 8 grains. *Dose* 10 grains, repeated every 4 or 6 hours.

What is the dose of tartar emetic as a *diaphoretic*? From $\frac{1}{12}$th to $\frac{1}{4}$th of a grain.

REFRIGERANT DIAPHORETICS.

What are some of the Refrigerant Diaphoretics? CITRATE OF POTASSA, ACETATE OF AMMONIA, NITRATE OF POTASSA, and SPIRIT OF NITRIC ETHER.

How is the *Citrate of Potassa* used? In two forms; the neutral mixture or saline draught, and the effervescing draught. *Dose* of the former, f℥ss every hour or two; of the latter, f℥ss of the alkaline solution, with f℥ss of the lemon-juice or the acid solution.

They are sometimes combined with tartar emetic, and also with spirits of nitre.

How is the *Acetate of Ammonia* used? In the form of the officinal solution called *liquor ammoniæ acetatis*, or *Spiritus Mindereri*. *Dose*, f℥ss to f℥j, repeated every 2 or 3 hours.

How is *Nitrate of Potassa* used? It is usually combined with tartar emetic, $\frac{1}{6}$th of a grain to 10 or 15 grains of the nitrate.

How is the *Spirit of Nitre* used? It is used in fevers where there is nervous derangement, or a typhoid tendency, and in children. *Dose*, 20 drops to fʒj, repeated.

ALTERATIVE DIAPHORETICS.

What are some of the Alterative Diaphoretics? The products of the *Guaiacum officinale*, *Mezereon*, *Sassafras*, and *Sarsaparilla*.

Guaiac. U. S.

What are the products of the *Guaiacum officinale*? The Guaicum wood, or *lignum vitæ*, and the Guaiac, a concrete juice. The medicinal properties of the wood are owing to the guaic which it contains. It grows in the West Indies and South America.

What are the *properties* and *uses* of guaic? It is stimulant, alterative, and promotes the secretions, particularly of the skin. *Dose* of *powder*, 10 to 30 grains, with sweetened water or mucilage. There are two officinal tinctures. *Dose* of either, fʒj. The wood is used in decoction, and is an ingredient in the *Compound Decoction of Sarsaparilla*.

Mezereon, *Mezereum*. U. S.

From what is Mezereon *obtained?* It is the bark of the root of different species of *Daphne;* a native of Europe.

What are its *properties* and *uses?* The recent bark, applied to the skin, inflames and vesicates. Given internally, it is stimulant, which may be directed to the skin or kidneys. *Dose* of the bark, in substance, 10 grains. Generally given in decoction with liquorice root, which is officinal. *Dose*, a teacupful four times a day.

Sassafras. U. S.

What are the officinal portions of the *Laurus Sassafras?* The

bark of the root (*Sassafras Radicis Cortex*), and the pith of the twigs (*Sassafras Medulla*).

What are the *medical properties* and *uses* of the bark? It is stimulant and diaphoretic. Its active principle is a *volatile oil*. *Dose*, from 2 to 10 drops. The infusion may be given *ad libitum*.

SARSAPARILLA. U. S.

What are the *properties* and *uses* of Sarsaparilla? It is the root of different species of the *Smilax*, growing in Mexico, West Indies, and South America. Its active principle is *sarsaparillin*. It acts upon the secretions, and thereby produces alterative effects. There are numerous officinal preparations. *Dose* of the *powder*, ʒss to ʒj; of the *compound decoction* (Sarsap. ℥vj: Sassaf., Guaiac., Glycyrrhiz., āā ℥j; Mezer. ʒiij; Aquæ Oiv), f℥iv; of the *compound syrup* (Sarsap. ℔ij; Guaiac. ℥iij; Ros. centifol., Sennæ, Glycyrrhiz., āā ℥ij; Ol. Sassafras, Ol. Anisi, āā ♏v; Ol. Gaultheria ♏iij; Alcohol dilut. Ox; Sacchr. ℔viij), ℥iiss; of the *alcoholic extract*, 10 to 20 grains; of the *fluid extract* (Sarsap ℥xvj; Rad. Glycyrrhiz., Rad. Sassaf., āā ℥ij; Mezereon ʒvj; Sacchr. ℥xij; Alcohol dilut. Oviij), fʒj.

EXPECTORANTS.

What are Expectorants? They are medicines which increase the secretion from the mucous membrane of the air-cells and air-passages of the lungs; or facilitate its discharge.

How do expectorants act? 1. By directly stimulating the bronchial secretion through the medium of the circulation. 2. By reduction of irritation and active congestion of the bronchial mucous membrane. 3. By moderate excitation of the circulation in the lungs. 4. By diminishing the amount of matter thrown out into the air-passages, in relaxed states of the tissues, thus enabling the organs to expel it with more facility. This is effected by what are called stimulating expectorants. 5. By stimulating the muscular power by stimulants when it is deficient. 6. By local applications to the bronchial mucous membranes by inhalation. As the therapeutic indications differ in different cases requiring expectorants,

the remedies calculated to effect one or the other of the above objects must be selected according to circumstances.

What circumstances should a patient be subjected to while using expectorants? The surface should be kept warm, and flannel worn next to the skin.

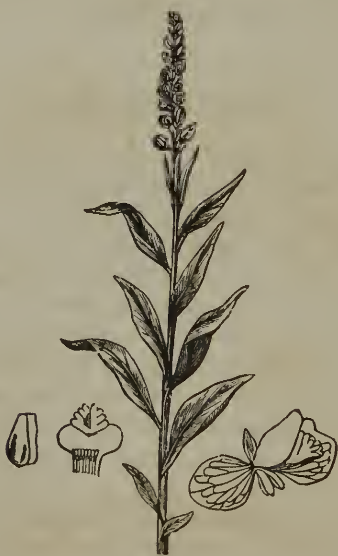
Are emetic substances usually expectorant in small doses? Yes; *ipecacuanha* in doses of 1 to 2 grains; *tartar emetic* in dose of $\frac{1}{8}$th of a grain; and their preparations also in this proportion.

What are the *properties* and *uses* of SQUILL as an expectorant? It stimulates the vessels of the lungs; and where there is much inflammation it should be preceded by blood-letting. The officinal preparations are the *vinegar*, *syrup*, *oxymel*, and *tincture*.

Dose of *vinegar*, fʒss to fʒj; of *syrup* and *oxymel*, from fʒj to fʒij; of *tincture*, from 20 to 40 drops.

What are the *properties* and *uses* of the bulb of the ALLIUM SATIVUM, or *Garlic*? It is a general stimulant, and promotes expectoration in debilitated states of the lungs. The expressed juice is often given to children with sugar. *Dose*, fʒss to fʒj.

Fig. 24.



SENEGA. U. S. (Fig. 24.)

What are the *properties* and *uses* of the root of the *Polygala Senega*, or *Seneka?* It active principle is *senegin.*

It is a stimulating expectorant, and diuretic; it also acts more or less on all the secretions.

Dose of *powder*, from 10 to 20 grains; of *decoction*, made by boiling ʒj of the root with ℥j of liquorice root in Ojss of water to Oj, given in doses of f℥i to f℥ij, 3 or 4 times a day. It is an ingredient in *Coxe's Hive Syrup.*

Fig. 25.

Black Snakeroot, *Cimicifuga.* U. S. (Fig 25.)

What are the *properties* and *uses* of the root of the *Cimicifuga racemosa*, or *black snakeroot*, or *cohosh?* It stimulates the secretions, and particularly those of the skin, kidneys, and bronchial mucous membrane.

Dose of *powder*, 10 to 30 grains; *decoction*, f℥j to f℥ij, repeated frequently.

Ammoniac, *Ammoniacum.* U. S.

From what is Ammoniac *obtained?* It is the inspissated juice of the *Dorema Ammoniacum*, an umbelliferous plant, growing in Persia. It comes in tears and masses.

What are its *properties* and *uses?* It is a stimulant and expectorant gum resin; mostly used in chronic catarrh, asthma, and other pectoral diseases. *Dose*, 10 to 30 grains in emulsion or pill.

Lac Ammoniaci (Ammoniac ʒij; Aquæ Oss) ℥ss to ℥j, when given alone; it is, however, more frequently given in combination, or forms a vehicle for other remedies.

Assafœtida. U. S.

What is the character of Assafœtida as an *expectorant?* It is an efficient expectorant and moderate stimulant. *Dose*, 5 to 15 or 20 grains, in pill or emulsion. *Mistura Assafœtida, Lac Assafœtida* (Assafœtida ʒij; Aquæ Oss), ℥ss to ℥ij for an adult.

Balsam of Tolu, *Tolutanum.* U. S.

From what is the Balsam of Tolu *obtained?* The *Myroxylon Toluiferum*, a tree growing in tropical America. Its essential constituents are a resin, volatile oil, and benzoic acid. It is procured by incising the trunk of the tree, and collecting the juice.

What are its *medical properties* and *uses?* It is a gently stimulating expectorant.

Dose, 10 to 30 grains in *emulsion*, of the *tincture*, fʒj to fʒij.

BALSAM OF PERU, *Myroxylon*. U. S.

What are the *properties* and *uses* of the balsam of the *Myroxylon Peruiferum*, or Peruvian Balsam? Its constituents are a resin, volatile oil, and benzoic acid. It is a warm, stimulating tonic, and expectorant. *Dose*, f ʒss.

STORAX. *Dose*, 10 to 30 grains.

BENZOIN. *Dose*, 10 to 30 grains.

COPAIBA. *Dose*, 20 to 30 drops, in emulsion.

MYRRH. Stimulating expectorant. *Dose*, 10 to 30 grains.

GALBANUM. *Dose*, 10 to 30 grains.

ELECAMPANE, or *Inula*. *Dose* of *decoction* (℥ss to Oj), f℥j to f℥ij.

WOOD NAPHTHA. *Dose*, 10 to 40 drops, three times a day, when an excitant expectorant is needed.

The Demulcent Expectorants are: *Gum Arabic, Marshmallow, Almonds, Olive Oil, Spermaceti, Sugar, Liquorice, Flaxseed, Tragacanth, Benne, Sassafras, Slippery Elm Bark, Iceland Moss*, &c.

CHOLAGOGUES.

What is meant by the term Cholagogues? Medicines which increase the flow of bile, either by increasing the secretion or facilitating its discharge from the gall-bladder. Remedies may effect this object by relieving irritation and congestion of the liver; by exciting the portal circulation, mechanically or otherwise; heat may excite the hepatic function, and also irritant substances applied to the mucous coat of the duodenum. The medicinal substances having cholagogue properties are *mercurials, nitromuriatic acid, chlorine water, aloes*, and *dandelion*.

EMMENAGOGUES.

What are Emmenagogues? They are medicines which promote the menstrual discharge.

How do emmenagogues act? They may act either through the medium of the circulation; or by an impression being made elsewhere, and extended sympathetically to the uterine vessels.

How should they be given so as to produce their full effect? A short time before the regular period of menstruation. The state of the uterine and general system should be carefully considered; if plethoric, their use should be preceded by depletion, and the milder ones of the class should be used. If debility exist, those of a tonic or stimulant character should be used; and if constipation attend, the cathartic emmenagogues are indicated.

What are the *properties* of the CHALYBEATES as regards their emmenagogue power? They are considered to be inferior to no other remedies in this respect, and are applicable where there is no local inflammation or general excitement. They are often combined with aloes and myrrh.

What are the *properties* of ALOES as an emmenagogue? It is very effective, and believed to exert a specific influence on the uterine vessels, independent of its cathartic property. *Dose*, 1 or 2 grains, 2 or 3 times a day. It may also be given in enema, about the period when menstruation should come on.

What is the *dose* of BLACK HELLEBORE as an emmenagogue? From fʒss to fʒi of the *tincture*, 2 or 3 times a day.

What are the *properties* of GUAIAC as an emmenagogue? It is applicable in cases associated with rheumatism, particularly in its neuralgic forms. Used in dysmenorrhœa either in the *simple* or *ammoniated tincture*. *Dose*, fʒj, 3 or 4 times a day.

What are the *properties* of the leaves of the JUNIPERUS SABINA, or *Savine*? They are highly stimulant, increase most of the secretions, and particularly those of the uterus.

The active principle is a volatile oil, called *oil of savine*. It should be avoided in pregnancy. *Dose* of the *powder*, from 5 to 20 grains, 2 or 3 times a day; of the *oil*, from 2 to 5 drops. The plant is a native of Europe.

What are the *properties* of CANTHARIDES as an emmenagogue? They exert a powerful stimulant effect over the urinary and genital organs.

Dose of the *tincture*, 10 to 30 drops three times a day.

EPISPASTICS.

What are Epispastics? Medicines that produce a blister when applied to the skin. They are called also *vesicatories*.

How do they exert a remedial influence? By acting indirectly as general stimulants; by their revulsive action; by substituting their own action for a diseased one in the part to which they are applied; by their local stimulus; by producing local depletion; by the pain they occasion, which may be useful in hypochondriacal cases; and they are employed to separate the cuticle for the purpose of applying medicines.

Spanish Fly, *Cantharis*. U. S.

What are the officinal preparations of the *Cantharis vesicatoria*, or *Spanish Fly*, as an epispastic? The *Cerate of Spanish Flies*, commonly called *Blistering Plaster*. Used for blistering.

The *Ointment*, used for maintaining a discharge.

The *Plaster of Pitch* with Spanish flies. Used as a rubefacient plaster.

The *Liniment* of Spanish flies, generally called Decoction of Flies in Oil of Turpentine. Used as an external stimulant.

What are the remedies for *strangury* produced by cantharides? The milder diuretics, such as uva ursi, sweet spirit of nitre, mucilages, &c.

Where are cantharides procured? In Spain and Italy. Active principle, *cantharidin*.

What are the *properties* of the indigenous insect, the *Cantharis Vittata*, or *Potato fly*? They are similar to the Spanish flies; the chemical composition and uses the same.

RUBEFACIENTS.

What are Rubefacients? They are medicines which inflame the skin, and produce redness without ordinarily vesicating.

What are the indications for the use of this class in preference to blisters? In cases where a sudden and powerful action is necessary; and in cases where a slight but long-continued action is desired — in which case the milder articles should be employed.

Will you enumerate the rubefacients commonly employed? The seeds of the *Sinapis alba* and *S. Nigra*, distinguished as *white* and *black mustard; Cayenne Pepper; Oil of Turpentine; Burgundy Pitch*, which is the product of the *Abies Communis*, growing in

the north of Europe; *Hemlock Pitch*, or *Pix Canadensis*, very analogous to the Burgundy Pitch; and *Aqua Ammoniæ*, which is much used in combination with sweet oil as *volatile liniment.*

ESCHAROTICS.

What are Escharotics? They are substances which destroy the life of the part to which they are applied, and produce sloughing. They operate by chemical agency, or by influencing the vitality of the part directly.

What substances are used for this purpose? The *Actual cautery; Moxa; Potassa*, or *common caustic; Nitrate of Silver*, or *Lunar caustic; Arsenious Acid*, or the *white oxide; Sulphate of Copper; Chloride of Mercury*, or *Corrosive sublimate; Burnt Alum;* and the *Mineral Acids.*

DEMULCENTS?

What are Demulcents? They are bland substances which form a viscid solution with water.

How do demulcents act? When applied to an inflamed surface, they protect it against irritating matters. Mixed with acrid substances, they blunt their acrimony, which are thereby rendered less irritating to parts with which they come in contact.

What medicines are used as demulcents? *Gum Arabic*, the product of several species of the *Acacia; Tragacanth; Slippery Elm Bark*, or the inner bark of the *Ulmus fulva; Flaxseed*, or the seeds of the *Linum usitatissimum; Liquorice Root*, or the root of the *Glycyrrhiza glabra; Iceland Moss*, or *Lichen Islandicus; Irish Moss*, or *Carrageen; Sago*, the product of the *Sagus Rumphii; Tapioca*, the product of the *Jatropha Manihot* of tropical America; *Arrow-Root*, the product of the *Maranta arundinacea* of the West Indies; and the *Barley*, called commonly pearl barley, or *hordeum perlatum.*

EMOLLIENTS.

What are Emollients? They are substances which retain moisture, and form a soft mass, without irritating properties.

DILUENTS.

What are Diluents? They are liquids which dilute the contents of the stomach and bowels, fill the bloodvessels, and increase and dilute the secretions. Water is the great diluent, to which additions are made to give it flavor.

MEDICINES UNCLASSIFIED.

ERGOT. U. S.

From what is *Ergot* obtained? It is a product of the *Secale cereale*, or common rye.

What are its *properties* and *uses*? It yields its virtues to water and alcohol. Its active principle is *ergotin*. It exhibits a strong tendency to the uterus, and operates with energy upon its contractile property; and reduces the frequency of the pulse. Bread made from rye contaminated with it, and long used, will, it is supposed, produce dry gangrene, typhus fever, diseases of the nervous system &c.

It is adapted to lingering cases of labor, where the os uteri is dilated, the external parts relaxed, and no mechanical impediment exists; the delay being ascribable solely to a want of energy in the uterus.

Dose of the *powder*, 20 to 30 grains; of the *infusion*, ℥j, made with ʒj of the ergot to f℥iv of water, to be repeated every 20 minutes until its peculiar effects are produced, or ʒij are given; of *ergotin* 5 to 10 grains.

NUX VOMICA. U. S.

From what is the *Nux Vomica* obtained? It is the seed of the *Strychnos Nux Vomica*, a tree growing in the East Indies. The active ingredients are *strychnia* and *brucia*.

What are its *properties* and *uses*? In very small doses, it is tonic, and operates upon the secretions. In larger doses, so as to produce a decided effect, its action is chiefly directed to the nerves of motion, producing a tendency to permanent, involuntary, mus-

cular contraction. It is sometimes used in paralytic affections, and its action appears to be particularly directed to the parts affected. It has also been recommended as an *antiperiodic;* supposed by some to possess more permanency of action than quinine in the cure of intermittents. *Dose* of the *powder*, 5 grains; of the *alcoholic extract*, from $\frac{1}{2}$ to 2 grains; of *strychnia*, from $\frac{1}{12}$th to $\frac{1}{6}$th of a grain.

Arsenic, *Arsenicum*. U. S.

What are the *properties* and *uses* of Arsenious Acid? Internally, it is alterative, febrifuge, and tonic, and peculiarly applicable in diseases of a periodical character. The effects should be carefully noted, and when there is any disposition to œdema produced, especially of the face and eyelids, or a feeling of stiffness, tenderness of the mouth, prickling in the eyelids, &c., it should be discontinued immediately. It has been used in scirrhus, anomalous ulcers, intermittent fever, diseases of the bones, and in cutaneous diseases. It is an ingredient in nearly all empirical, external remedies for cancer.

Dose, $\frac{1}{12}$th of a grain in pill, and taken 3 times a day; of *Fowler's solution*, 10 drops, 2 or 3 times a day.

Mercury, *Hydrargyrum*. U. S.

What are the preparations of *Mercury* that are used medicinally, and their doses as *alteratives* or *sialagogues?* *Mercurial Ointment*, or *Unguentum Hydrargyri; Mercurial Plaster*, or *Emplastrum Hydrargyri; Mercurial Pills*, or *Pilulæ Hydrargyri*, commonly called *blue pills*. *Dose*, 1 pill 3 times a day as a *sialagogue;* 1 every night, or every other night as *alterative.* The officinal pill weighs 3 grains, and contains 1 grain of mercury; *Mercury with chalk*, or *Hydrargyrum cum Cretâ*, dose, 5 to 20 grains twice daily; *Black Oxide of Mercury*, or *Hydrargyri Oxidum Nigrum*, dose 1 to 3 grains 2 or 3 times a day; *Red Oxide of Mercury*, or *Hydrargyri Oxidum Rubrum*, commonly called *red precipitate*, used externally as an *escharotic* and *stimulant*—the officinal ointment called *Unguentum Hydrargyri Oxidi Rubri; Mild Chloride of Mercury*, or *Hydrargyri Chloridum Mite*, commonly called *calomel*, dose, from $\frac{1}{2}$ a grain to 1 grain 3

times daily; *Corrosive Chloride of Mercury, Hydrargyri Chloridum Corrosivum*, commonly called *corrosive sublimate*, dose from $\frac{1}{8}$th to $\frac{1}{4}$th of a grain 3 or 4 times a day; *Yellow Sulphate of Mercury*, or *Hydrargyri Sulphas Flavus*, commonly called *Turpeth mineral*, dose, as an *alterative*, from $\frac{1}{2}$ a grain to 1 grain, and from 2 to 5 grains as an *emetic* — seldom used — sometimes as an *errhine*, diluted with five parts of starch; *Ammoniated Mercury*, or *Hydrargyrum Ammoniatum*, commonly called *white precipitate*, used externally; *Nitrate of Mercury*, used only as an ointment, called the *Ointment of Nitrate of Mercury*, or *Unguentum Hydrargyri Nitratis*, commonly called *citrine ointment; Red Sulphuret of Mercury, Hydrargyri Sulphuretum Rubrum*, commonly called *cinnabar*, used only for fumigation; *Black Sulphuret of Mercury*, or *Hydrargyri Sulphuretum Nigrum*, formerly called *Ethiops mineral*, scarcely ever used at present.

Iodine. U. S.

What are the *properties* and *uses* of Iodine? It operates as a general excitant, but particularly of the glandular and absorbent systems.

If long continued, or given in very large doses, it gives rise to derangement of the nervous system, restlessness, palpitation, a sense of burning along the gullet, excessive thirst, acute pain in the stomach, violent cramps, rapid and great emaciation, and frequent pulse. The condition of the system in which any of these poisonous effects are exhibited is called *iodism*. It is used in glandular enlargements and morbid growths. *Dose* $\frac{1}{4}$ to $\frac{1}{2}$ of a grain 3 times a day. It is never used in powder, but dissolved in alcohol or a watery solution of the iodide of potassium. *Dose* of the officinal *tincture*, 10 to 20 drops.

The *Iodide of Potassium* is officinal. *Dose*, 1 to 2 grains. *Lugol's solution* is iodine ℈j, iodide of potassium ℈ij, and water ℥vii. *Dose*, 6 drops, repeated. *Iodine ointment*, ℥j of lard, and ℈j of iodine. Also iodine gr. v, hydriod. potassæ ℈j, ung. hydrarg. ℥j, rubbed well together.

ANTACIDS.

What are Antacids? Substances capable of combining with and neutralizing acids.

What substances are used as antacids? The *carbonates of potassa* and *soda, ammonia, lime*, and *magnesia.*

ANTHELMINTICS.

What are Anthelmintics? Substances which operate on worms in the alimentary canal, and render them easy of expulsion.

PINKROOT, *Spigelia.* U. S. (Fig. 26.)

From what is Pinkroot *obtained?* It is the root of the *Spigelia Marilandica*, and is the only part of the plant which is officinal.

What are its *properties* and *uses?* It is considered to be one of the most powerful of the anthelmintics. In over doses, it determines to the brain, giving rise to vertigo, dimness of vision, spasms, &c. *Dose* of the *powder* for a child from 2 to 4 years old, 10 to 20 grains, repeated twice a day, and followed by a cathartic; sometimes it is combined with calomel; of the *infusion*, for a child, f℥ss to f℥j, 3 or 4 times a day, made with ℥ss of the root to Oj of water; often given with ℥ss of senna added, in the same dose.

PRIDE OF CHINA, *Azedarach.* U. S.

What are the *properties* of the bark of the root of the *Melia Azedarach*, or Pride of China? Used in *decoction*, made by boiling Oij of water with ℥iv of the fresh root to Oj. *Dose* for a child, ℥ss every 2 or 3 hours, and followed by a cathartic.

WORMSEED, *Chenopodium.* U. S.

From what is *Wormseed obtained?* They are the seeds of the *Chenopodium Anthelminticum.*

What is the *dose?* In *substance*, bruised, ℈j to ℈ij for a child; of the *volatile oil*, from 4 to 8 drops for a child, repeated twice a day.

Fig. 26.

What are the *properties* and *uses* of COWHAGE? The spiculæ are vermifuge, and act mechanically on the worm. *Dose* of the *electuary* for an adult, ℥ss; for a child 3 or 4 years old, ʒj.

What is the *dose* of the *oil of turpentine* as an anthelmintic? For an adult, from f℥ss to f℥ij, or even more, followed with castor oil; for children, in proportion.

What is the *dose* of STANNUM, or *Tin*, as an anthelmintic? From ʒj to ℥j.

What are the *properties* of POMEGRANATE BARK? The bark of the root is powerfully anthelmintic; used in the expulsion of *tapeworm*. Used in *decoction* (℥ij in Oij of water boiled to Oj), one-third to be taken every half hour.

TABLE OF SIGNS AND ABBREVIATIONS.

℞	Recipe.	Take.
āā	Ana.	Of each.
℔	Libra vel libræ.	A pound or pounds.
℥	Uncia vel unciæ.	An ounce or ounces.
ʒ	Drachma vel drachmæ.	A drachm or drachms.
℈	Scrupulus vel scrupuli.	A scruple or scruples.
O	Octarius vel octarii.	A pint or pints.
f℥	Fluiduncia vel fluidunciæ.	A fluidounce or fluidounces.
fʒ	Fluidrachma vel fluidrachmæ.	A fluidrachm or fluidrachms.
♍	Minimum vel minima.	A minim or minims.
Chart.	Chartula vel chartulæ.	A small paper or papers.
Coch	Cochlear vel cochlearia.	A spoonful or spoonfuls.
Collyr.	Collyrium.	An eye-water.
Cong.	Congius vel congii.	A gallon or gallons.
Decoc.	Decoctum.	A decoction.
Ft.	Fiat.	Make.
Garg.	Gargarysma.	A gargle.
Gr.	Granum vel grana.	A grain or grains.
Gtt.	Gutta vel guttæ.	A drop or drops.
Haust.	Haustus.	A draught.
Infus.	Infusum.	An infusion.
M.	Misce.	Mix.
Mass.	Massa.	A mass.
Mist.	Mistura.	A mixture.
Pil.	Pilula vel pilulæ.	A pill or pills.
Pulv.	Pulvis vel pulveres.	A powder or powders.
Q. S.	Quantum sufficit.	A sufficient quantity.
S.	Signa.	Write.
Ss.	Semis.	A half.

EXAMPLES OF COMMON EXTEMPORANEOUS PRESCRIPTIONS.

Powders.

℞. Antimonii et Potassæ Tartratis, gr. i.
Pulveris Ipecacuanhæ, ℈i.
Fiat pulvis.
S. To be taken in a wineglassful of sweetened water.
An active emetic.

℞. Hydrargyri Chloridi Mitis,
Pulveris Jalapæ, āā gr. x.
Misce.
S. To be taken in syrup or molasses.
An excellent cathartic in the commencement of bilious fevers, and in hepatic congestion.

℞. Pulveris Jalapæ, gr. x.
Potassæ Bitartratis, ʒii.
Misce.
S. To be taken in syrup or molasses.
A hydragogue cathartic, used in dropsy and scrofulous inflammation of the joints.

℞. Sulphuris, ʒi.
Potassæ Bitartratis, ʒii.
Misce.
S. To be taken in syrup or molasses.
A laxative, used in piles and cutaneous diseases.

℞. Pulveris Rhei, gr. x.
Magnesiæ, ʒss.
Fiat pulvis.
S. To be taken in syrup or molasses.
A laxative and antacid, used in diarrhœa, dyspepsia, &c.

℞. Pulveris Scillæ, gr. xii.
Potassæ Nitratis, ʒi.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken twice or three times a day in syrup or molasses.
A diuretic, employed in dropsy.

℞. Potassæ Nitratis, ʒi.
Antimonii et Potassæ Tartratis, gr. i.
Hydrargyri Chlorid. Mitis, gr. vi.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken every two hours in syrup or molasses.
A refrigerant, diaphoretic, and alterative, used in bilious fevers; usually called *nitrous powders.*

℞. Pulveris Guaiaci Resinæ,
Potassæ Nitratis, āā ʒi.
Pulveris Ipecac. gr. iii.
Opii, gr. ii.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken every three hours in syrup or molasses.
A stimulant diaphoretic, used in rheumatism and gout after sufficient depletion.

℞. Ferri Subcarbonatis,
Pulveris Columbæ,
Pulveris Zingiberis, āā ʒi.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken three times a day in syrup or molasses.
A tonic, used in dyspepsia and general debility.

Pills.

℞. Pulveris Aloes,
Pulveris Rhei, āā ʒss.
Saponis ℈i.

Misce, et cum aqua fiat massa in pilulas viginti dividenda.

S. Two or three to be taken daily, at bedtime, or before a meal.

An excellent laxative in habitual constipation.

℞. Massæ Pilularum Hydrargyri,
Pulveris Aloes,
Pulveris Rhei, āā ℈i.
Misce, et cum aqua fiat massa in pilulas viginti dividenda.

S. Three to be taken at bedtime.

An alterative and laxative, useful in constipation, with deranged or deficient hepatic secretion.

℞. Pulveris Aloes,
Extracti Quassiæ, āā ʒi.
Olei Anisi, ♏x.
Syrupi, q. s.
Misce, et fiat massa in pilulas triginta dividenda.

S. Two to be taken once, twice, or three times a day.

A laxative, tonic, and carminative. useful in dyspepsia.

℞. Pulv. Rhei,
Sapo Alba,
Myrrhæ,
Assafœtida, āā ʒss.
Misce, et fiat massa in pilulas triginta dividenda.

S. One or two to be taken after each meal.

Useful in promoting digestion, and relieving pain and uneasiness of the stomach.

℞. Pulveris Scillæ, ℈i.
Hydrargyri Chloridi Mitis, gr. x.
Pulveris Acaciæ,
Syrupi, āā q. s.
Misce, et fiat massa in pilulas decem dividenda.

S. One to be taken two or three times a day.

A diuretic and alterative, much used in dropsy, especially when complicated with organic visceral disease.

℞. Pulveris Opii, gr. iv.
Pulveris Ipecacuanhæ, gr. xvii.
Pulveris Acaciæ,
Syrupi, āā q. s.
Misce, et fiat massa in pilulas duodecim dividenda.

S. One to be taken after each stool.

An anodyne diaphoretic, useful in dysentery and diarrhœa, after the use of laxatives.

℞. Pulveris Opii,
Pulveris Ipecacuanhæ, āā gr. iii.
Hydrargyri Chloridi Mitis, gr. iv.
Pulveris Acaciæ,
Syrupi, āā q. s.
Misce, et fiat massa in pilulas tres dividenda.

S. One or more to be taken at bedtime, or according to circumstances.

An anodyne, diaphoretic, and alterative, very useful in diarrhœa, dysentery, typhoid pneumonia, and various other diseases.

℞. Plumbi Acetatis in pulverem triti, gr. xii.
Pulveris Opii, gr. i.
Pulv. Acaciæ,
Syrupi, āā q. s.
Ut fiat massa in pilulas sex dividenda.

S. One every two, three, or four hours.

An astringent much employed in hæmoptysis and uterine hemorrhage.

Mixtures.

℞. Magnesiæ, ʒi.
Syrupi, f℥i.
Tere simul, et effunde
Aquæ Acidi Carbonici, f℥iv.
Fiat haustus.

S. To be taken at a draught, the mixture being well shaken.

An agreeable mode of administering magnesia.

℞. Mannæ, ℥i.
Fœniculi contusi, ʒi.
Aquæ bullientis, f℥iv.
Fiat infusum et cola; dein adjice,
Magnesiæ carbonatis, ʒii.
Ft. Mist.

S. One-third to be taken every three or four hours till it operates, the mixture being shaken.

An excellent carminative and mild laxative, in flatulence and pain in the bowels.

℞. Olei Ricini, f℥i.
Pulveris Acaciæ,
Sacchari, āā ʒii.
Aquæ Menthæ Piperitæ, f℥iii.
Acaciam et saccharum cum fluiduncia dimidia aquæ menthæ tere; dein oleum adjice, et contere; denique aquam reliquam paulatim infunde, et omnia misce.

S. To be taken at a draught, the mixture being well shaken.

℞. Olei Ricini, f℥i.
Vitellum ovi unius.
Tere simul, et adde,
Syrupi, f℥ss.
Aquæ Menthæ Piperitæ, f℥ii.
Ft. haust.

S. To be taken at a draught, the mixture being well shaken.

This and the preceding formula afford convenient modes of administering castor oil, when the stomach is irritable. Any other fixed oil may be given in the same way.

℞. Olei Ricini, f℥iss.
Tincturæ Opii, ♏ xxx.
Pulv. Acaciæ,
Sacchari, āā ʒij.
Aquæ Menthæ Viridis, f℥iv.
Acaciam et saccharum cum palulo aquæ menthæ tere; dein oleum adjice, et iterum tere; denique aquam reliquam paulatim infunde, et omnia misce.

S. A tablespoonful to be taken every hour, or two hours, till it operates, the mixture being each time well shaken.

Used as a gentle laxative in dysentery and diarrhœa. It is usually known by the name of *oleaginous mixture.*

℞. Elaterii, gr. i.
Spiritus Ætheris Nitrici, fʒij.
Tincturæ Scillæ,
Oxymellis Colchici, āā fʒss.
Syrupi, f℥i.
Ft. Mist.

S. A teaspoonful to be taken three or four times a day in a little water.

Diuretic, used in Ferriar dropsy.

℞. Copaibæ,
Spiritus Lavandulæ Comp., āā fʒii.
Mucilaginis Acaciæ, fʒss.
Syrupi, fʒiii.
Simul tere; dein paulatim affunde,
Aquæ, f℥iv.
Misce.

S. A tablespoonful to be taken four times a day, or more frequently.

Given in chronic catarrhs, and chronic nephritic affections. The dose must be larger in gonorrhœa.

Neutral Mixture.

℞. Acidi Citrici, fʒii.
Olei Limonis, ♏i.
Simul tere, et adde,
Aquæ, f℥iv.
Liqua, et adde,
Potassæ Carbonatis, q. s. ad saturand.
Misce, et per linctum cola.

Or,

℞. Succi Limonis recentis, f℥iv.

Potassæ Carbonatis, q. s. ad saturandum.
Misce et cola.

S. A tablespoonful to be given with an equal quantity of water every hour or two hours.

An excellent diaphoretic in fever.

Effervescing Draught.

℞. Potassæ Carbonatis, ʒii.
Aquæ, f℥iv.
Liqua.

Or,

℞. Potassæ Bicarbonatis, ʒiij.
Aquæ, f℥iv.
Liqua.

S. Add a tablespoonful of the solution to the same quantity of lemon or lime juice, previously mixed with a tablespoonful of water; and give the mixture, in a state of effervescence, every hour or two hours.

An excellent diaphoretic and anti-emetic in fever, with nausea or vomiting.

Brown Mixture.

℞. Pulv. Extract. Glycyrrhizæ,
Pulv. Acaciæ, āā ʒii.
Aquæ ferventis, f℥iv.
Liqua, et adde,
Vini antimonii, fʒii.
Tincturæ Opii, ♏xx.
Ft. Mist.

S. A tablespoonful to be taken occasionally.

Expectorant, demulcent, and anodyne, useful in catarrhal affections.

℞. Antimonii et Potassæ Tartratis, gr. j.
Syrupi Scillæ,
Liquoris Morphiæ Sulphatis, āā f℥ss.
Pulveris Acaciæ, ʒii.
Syrupi, f℥ss.
Aquæ fluvialis, f℥iv.
Ft. Mist.

S. A tablespoonful to be taken occasionally.

An expectorant and anodyne cough mixture.

℞. Acidi Nitrosi, fʒi.
Tincturæ Opii, gtt. xl.
Aquæ Camphoræ, f℥viii.
Misce.

S. One-fourth to be taken every three or four hours.

Hope's mixture, used in dysentery, diarrhœa, and cholera.

℞. Camphoræ, ʒi.
Myrrhæ, ʒss.
Pulv. Acaciæ,
Sacchari, āā ʒii.
Aquæ, f℥vi.
Camphoram cum alcoholis paululo in pulverem tere; dein cum myrrha, acacia, et saccharo contere; denique cum aqua paulatim instillata misce.

S. A tablespoonful to be taken for a dose, the mixture being well shaken.

A convenient form for administering camphor.

℞. Cretæ preparatæ, ℈iv.
Massæ Pil. Hydrarg, gr. viii.
Tincturæ Opii, gtt. viii.
Pulveris Acaciæ,
Sacchari, āā ʒi.
Aquæ Cinnamomi,
Aquæ, āā fʒ.
Solida simul tere, dein liquida paulatim inter terendum adjice, et omnia misce.

A teaspoonful to be taken for a dose, the mixture being well shaken.

An antacid and alterative mixture, well adapted to infantile diarrhœa with white stools. The

dose mentioned is for a child a year or two old, and may be repeated four or six times in twenty-four hours.

℞. Pulveris Kino, ℨii.
Aquæ bullientis, f℥vi.
Fiat infusum et cola; dein secundum artem admisce.

℞. Cretæ præparatæ, ℨiii.
Tincturæ Opii, fℨss.
Spiritus Lavandulæ compositi, f℥ss.
Pulveris Acaciæ,
Sacchari, āā ℨii.
S. A tablespoonful to be taken for a dose, the mixture being well shaken.
Astringent and antacid, useful in diarrhœa.

Solutions.

℞. Magnesiæ Sulphatis, ℥j.
Syrupi Limonis, f℥i.
Aquæ Acidi Carbonici, f℥vi.
Misce.
S. To be taken at a draught.
An agreeable mode of administering sulphate of magnesia.

℞. Potassæ Nitratis, ℨi.
Antimonii et Potassæ Tartratis, gr. i.
Aquæ fluvialis, f℥iv.
Liqua.
S. A tablespoonful to be taken every two hours.
A refrigerant diaphoretic, used in fevers.

℞. Magnesiæ,Sulphatis, ℥j.
Antimonii et Potassæ Tartratis,gr.i.
Succi Limonis recentis, f℥i.
Aquæ, f℥iii.
Misce.
S. A tablespoonful to be taken every two hours till it operates on the bowels.
Useful in fevers.

℞. Quiniæ Sulphatis, gr. xii.
Acidi Sulphurici Aromatici, ♍xx.
Syrupi, f℥ss.
Aquæ Menthæ Piperitæ, f℥i.
Misce.
S. A teaspoonful to be taken every hour, or two hours.
A good mode of administering sulphate of quinia in solution.

Infusions.

℞. Sennæ, ℨiii.
Magnesiæ Sulphatis,
Mannæ, āā ℥ss.
Fœniculi, ℨi.
Aquæ bullientis, Oss.
Macera per horam in vase leviter clauso et cola.
S. Give a teacupful every three or four hours till it operates.
An excellent purgative in febrile complaints.

℞. Columbæ Contusæ,
Zingiberis contusii, āā ℥ss.
Sennæ, ℨii.
Aquæ bullientis, Oi.
Macera per horam in vase leviter clauso et cola.
S. A wineglassful to be taken morning, noon, and evening, or less frequently, if it operates too much.
An excellent remedy in dyspepsia, with constipation and flatulence.

℞. Spigeliæ, ℥ss.
Sennæ, ℨii.
Mannæ, ℥j.
Fœniculi, ℨii.
Aquæ bullientis, Oi.
Macera per horam in vase leviter clauso et cola.
S. A wineglassful to be given to a child from two to four years old, three or four times a day
A powerful anthelmintic.

℞. Pulveris Cinchonæ. Rubræ, ℥i.
Acidi Sulphurici Aromatici, f℥i.
Aquæ, Oi.
Macera per horas duodecim, subinde agitans.

S. A wineglassful of the clear liquid to be taken for a dose.
A good method of administering Peruvian bark in cold infusion.

℞. Ext. Hyoscyam. gr. x.
Vini antim. fʒij.
S. Eight drops four times a day to an infant a year old, in whooping-cough. (*Hufeland.*)

℞. Aq. fœniculi, fʒiv.
Vini Antimonii, fʒj.
Ext. hyoscyam. gr. iij.
Syrup. althææ, f℥jss.
S. A teaspoonful every two hours to an infant from six to twelve months old, as a cough mixture. (*Vogt.*)

℞. Ext. belladonnæ, gr. j.
Aq. destil. ℥j.
S. To infants, five drops four times a a day, in whooping cough. (*Wendt.*)

℞. Magnesiæ, ℈j.
Tinct. fœtid. gt. lx.
——— opii, gt. xx.
Aquæ font. f℥j.
M. Twenty drops to a child from two weeks to one month, in colic; if not relieved in half an hour, ten drops more—increasing the dose as the child advances in age. (*Dewees.*)

Carminatives and Antacids.

℞. Magn. carb. ʒss.
Tinct. rhei, fʒj.
Aq. menth. f℥vj.
Syrup. alth. f℥j.
M. Sit mistura.
S. A teaspoonful every hour for an infant of six months, troubled with acidity of the stomach. (*Vogt.*)

℞. Aquæ fœniculi, ʒvij.
Potassæ bicarb. ℈ij.
Syrupi, f℥j.
M. A dessertspoonful occasionally. (*Hamilton.*)

℞. Potassæ bicarb. ʒss.
Aq. destil. f℥iss.
Solve.
S. Ten to forty drops daily in infantile convulsions. (*Hamilton.*)

Antispasmodics.

℞. Cretæ, gr. iij.
Mosch. gr. ss.
Croci, gr. i.
Ft. pulv. dent. tal. dos. No. iv.
S. One every hour for an infant. (*Frankel.*)

℞. Moschi, gr. vj.
Ammon. sesquicarb. gr. iv.
Sacchari albi, ʒiij.
Misce terendo, et adde,
Aq. flor. sambuci, ℥ijss.
M. Sit mistura.
S. A teaspoonful every hour in infantile fits. (*Wendt.*)

Expectorants and Demulcents.

℞. Pulv. Ipecacuanhæ,
Calomelanos. āā gr. x.
Sacchar. albi, gr. xx.
S. One or two grains every second or third hour, as an expectorant in bronchial irritation. (*Evanson and Maunsell.*)

℞. Decoct. polyg. seneg. f℥iijss.
Oxymel. scillæ, fʒij.
Vini ipecac. fʒij.
Antim. tart. gr. j.
S. Ten minims to a scruple, as an expectorant. (*Evanson and Maunsell.*)

℞. Mist. acaciæ, f℥iss.

Aquæ puræ, f℥iijss.
Syrupi, f℥ss. M.
S. A teaspoonful every two or three hours, for an infant from four to six months old.

℞. Rad. seneg. ʒss.
Infus. in s. q. aq. fervid. per ¼ hor. colatur, f℥iv.
Adde.
Ammoniæ hydrochl. ℥ss.
Syrup. Althææ, f℥j.
S. A teaspoonful every two hours to an infant. (*Wendt.*)

℞. Potass. tart. ʒj.
Vin. antim. fʒss.
Aquæ anethi, f℥j.
Oxymel. scillæ, f℥ss.
Ext. glycyrrh. ʒj. M.
S. One or two teaspoonfuls for an infant of twelve or eighteen months, in catarrhal fever. (*Frankel.*)

℞. Pulv. ipecac. gr. iij.
Pulv. acaciæ,
Magnes. carb. āā ʒss.
Sacchari albi, ʒj. M.
Ft. pulvis divid. in xij æquales part.
S. A powder every two hours in whooping cough. (*Volger.*)

℞. Tincturæ opii camph. f℥j.
Vin. antim. f℥ss.
Succ. glycyrrh. ʒiij.
Pulv. g. acaciæ, ʒij.
Aquæ fervent. f℥vj.
S. A teaspoonful every two or three hours during the night, to a child six months old, in troublesome cough. (*Dewees.*)

℞. Emulsio amygd. ℥iv.
Syrup. simpl. ℥j.
Gum. tragacanth. gr. vi. M.
S. To be given by the teaspoonful. (*H. des Enf.*)

Astringents.

℞. Hydr. c. creta, ʒj.
Pulv. ipecac. comp. ℈ij.
Magn. carb. ʒss.
Tere bene simul.
S. Four to six grains, as a sedative for infants. (*Copland.*)

℞. Cretæ ppt. ʒiij.
Tinct. thebaic. gt. xx vel xxx.
Ol. cinnam. gt. j.
Sacchar. alb. ʒij.
Aq. font. fʒij. M.
S. A teaspoonful every two, three, or four hours. (*Dewees.*)

External Applications.

℞. Antim. tart. ʒj
Aq. ferv. f℥j.
Tinct. cantharid. f℥j.
S. An embrocation in whooping cough.

℞. Ol. oliv. f℥ij.
Ol. succin.,
Ol. caryoph., āā ℥ss.
S. An embrocation in whooping cough.

℞. Sulph. cupri, ʒij.
Pulv. cinchon. ℥ss.
Aquæ, f℥iv.
S. To be applied twice a day to a gangrene of the cheek. (*Dr. Coates.*)

Baths.

℞. Potassæ sulphur. ℥ij.
Aquæ, ℔j.
This bath differs from the artificial Barège water, in containing half the quantity of sulphuret of potass.
S. Used in psora. (*H. des Enfans.*)

℞. Sulph. sublim.,
Acetatis plumbi, āā ʒj.
Zinci sulph. ʒss.
S. Used in psora. (*H de la Matern.*)

Enemata.

℞. Syrup. papav. f ʒij.
Decoct. amyli, f ℥viij.
S. In diarrhœa of infants.
(*H. de la Matern.*)

℞. Cap. papav. No. j.
Decoc. lini, ℔iij.
(*H. de la Matern.*)

℞. Cap. papav. ʒij.
Aquæ, ℔j. (*H. des Enfans.*)

℞. Amyli, ℥j.
Aquæ, ℔ij. (*H. des Enfans.*)

℞. Flor. anthemidis, ʒij.
Aquæ, ℔j.
S. Ft. enema. For infantile colic.

Purgatives.

℞. Pulv. rad. jalap. gr. xxiv.
Calomelanos, gr. iv.
Sacchari alb. ʒij. M.
Ft. pulvis. divid. in xij partes æquales.
S. A teaspoonful twice a day for a six months' infant, in obstruction of the bowels. (*Wendt.*)

℞. Calomelanos, gr. iij.
Pulv. rhei,
Oleo-sacch. fœnic, āā ℈j.
Ft. pulvis.
S. One-third of the above quantity is a dose for an infant, as a laxative. (*Fischer.*)

℞. Ol. ricini f ʒiij — iv.
Pulv. acaciæ, q. s.
Aq. fœnic. f ʒij.
Mannæ, ℥ss.
Fiat emulsio.
S. A dessertspoonful, repeated every hour till it operates. (*Berends.*)

℞. Ol. ricini, f ℥ss.
Syrup. rosæ, f ℥ss.
Vitel ovi un.
Tinct. sennæ, ʒiss.
S. One or two spoonfuls for an infant.

℞. Mannæ, ℥ss.
Emulsio arab. f ℥ss.
Syrup. violæ, f ʒij.
Bene admisce, et adde,
Aquæ menth. f ℥j. M.
S. From f ʒj to f ʒij every third hour, until an effect is produced.
(*Evanson and Maunsell.*)

℞. Infusi sennæ, ℥j.
Aquæ menthæ, ℥ss.
Magnesiæ, ℈j.
Mannæ, ʒii.
Tinct. rhei, ʒj.
Syrup. rosæ, ʒij. M.
S. From ʒj to ʒij every third hour.
(*Evanson and Maunsell.*)

℞. Mag. calcin. ʒss.
Pulv. rhei, gr. vj.
Sacchar. albi, ʒj.
Ol. menth. gt. vj.
Aquæ, f ℥iss.
S. A desertspoonful every two hours.
(*H. d'Amer.*)

Emetics.

℞. Vini antim. f ℥ss.
Syrup. althææ, f ℥j.
S. A teaspoonful every quarter of an hour to a child three or four months old. (*Wendt.*)

℞. Pulv. ipecac. gr. xij.
Syrup. simpl. f ℥j.
S. A teaspoonful every quarter of an hour to an infant five or six months old.

℞. Vin. antim. ℥ss.
Oxymel. scillæ, f ʒij.
S. A teaspoonful for an infant at the breast. (*Frankel.*)

℞. Aquæ, f ℥j.
Vini ipecac. f ℥ss.
Syrupi, f ℥ss.
S. One or two drachms frequently, till vomiting ensues.
(*Evanson and Maunsell.*)

Tonics and Stimulants.

℞. Ferri tart. ʒj.
Syrup. simpl. q. s.
M. Ft. bol., No. iij.
S. As a tonic for debilitated infants. (*H. des Enfans.*)

℞. Cinchonæ, ℥ss.
Aquæ, ℔j. M.
S. To be used as an enema when the stomach rejects cinchona. (*H. des Enfans.*)

℞. Aquæ destillat. f℥iss.
Quinæ disulph. gr. ij.
Acid. sulph. aromat. gtt. xvj.
Syrupi caryoph. f℥ss. M.
S. From one to two drachms thrice a day. (*Evanson and Maunsell.*)

℞. Sal. martis, gr. ij.
Acid. sulph. gt. x.
Sacchari albi, ʒj.
Aquæ font. M.
Dose, ʒj in chronic stages of cholera infantum. (*Chapman.*)

Wine Whey.

℞. Lactis vac. Oss.
Vin. alb. ℥j vel ℥ij.
S. Boil the milk, then add the wine.

External Applications.

℞. Unguent. cetacei, ℥j.
Oxydi zinci,
Pulv. lycopodii, āā ℈ss.
S. Useful in ulceration of the eyelids. (*Hufeland.*)

℞. Croci sativ. ʒj.
Aquæ fervent. ℥iv.
Vin. opii, ʒj.
S. Anodyne collyrium. To be used when there is great pain. (*Jadelot.*)

℞. Flores anthemidis,
Acet. commun., āā ℥iv.
A common revulsive. (*H des Enfans.*)

℞. Cataplasm. emol. ℔ij.
Ung. resinos. ℥j. M.
Useful to hasten the suppuration of a phlegmonous tumor.

℞. Pulv. lini. q. s.
Decoc. rad. alth. q. s. M.
An emollient cataplasm.

℞. Cataplasm. emol. ℥iv.
Farinæ sinap. ʒiv. M.
Used as a revulsive. (*H. des Enfans.*)

Stimulant.

℞. Sp. ammon. arom. fʒss.
Syrup. althææ.
Aquæ fœniculi, fʒj. M.
S. A teaspoonful for an infant every hour. (*Frankel.*)

Alterative.

℞. Calomelanos, gr. iij.
Amyli, ʒss.
Sacch. albi, ʒiss. M.
Ft. pulvis divid. in xii partes æquales.
S. One thrice a day in infantile syphilis. (*Wendt.*)

APOTHECARIES' WEIGHT. *U. S., Lond., Ed., Dub.*

Pound.		Ounces.		Drachms.		Scruples.		Grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	3	=	60
						℈ 1	=	gr. 20

APOTHECARIES' OR WINE MEASURE. *U. S.*, *Dub.*

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.		Cubic Inches.
Cong. 1	=	8	=	128	=	1024	=	61440	=	231
		O 1	=	16	=	128	=	7680	=	28·875
				f℥ 1	=	8	=	480	=	1·8047
						fʒ 1	=	♏ 60	=	·2256

DIETETIC PREPARATIONS.

BISCUIT JELLY.

White biscuit, ℥iv, water Oiv, boil down one half, strain, evaporate to Oj add white sugar ℔j, red wine, ℥iv, cinnamon water, ʒj. In debility of the digestive organs.

HARTSHORN JELLY.

Hartshorn shavings, ℥j, water, Oiv, boil to Oij, strain; warm again with orange juice, ℥j, white sugar, ℥vj, sherry, ℥v.

ANOTHER.

Hartshorn shavings, ℥viii, water, Oiv, boil, strain, add white wine and sugar, each, ℥iv, or, if a very clear jelly is required, syrup of vinegar, ℥vi; clarify with the white of two eggs, and strain, flavoring with cinnamon or lemon peel.

SAGO JELLY.

Soak sago in water for an hour, pour it off, adding more, boil till the sago is transparent, then add wine and sugar.

TAPIOCA JELLY.

Soak it in water for nine hours, then boil it gently till quite clear, and add lemon-juice and peel, wine, sugar, and cinnamon.

GLOUCESTER JELLY.

Rice, sago, pearl barley, hartshorn shavings, Rad. Eringii, each, ℥j, boil in ℔iij of water to ℔j, and strain; nutritive, dissolved in broth, wine, or milk.

ALMOND JELLY.

Sweet almonds, blanched, ℥i, white sugar, ʒvj, water, ℥i.. Rub into an emulsion, strain, and add melted hartshorn jelly, ℥viii, orange flower water, ʒj, essence of lemon, gtt. iij.

BRANDE'S JELLY.

Ground jalap, ℥ii, water, Oxii, calcined magnesia, ℥iii, boil to a jelly; not subject to grow mouldy.

CREME DE RIS.

Rice, three spoonfuls; boil in two pints of water to one, strain; add sweet almonds, No. x., bitter almonds, No. v., make an emulsion with sugar, a little cinnamon or orange-flower water, and drink it warm in the morning.

ISINGLASS JELLY.

Isinglass, ℥ii, water, two pints, boil to one, strain, and add milk one pint, white sugar candy, ℥i. Nutritive.

CHICKEN JELLY.

Cut a chicken into small pieces, bruise the bones, and put the whole into a stone jar, with a cover that will make it water-tight. Set the jar in a large kettle of boiling water, and keep it boiling for three hours. Then strain off the liquid, and season it slightly with salt, pepper, and mace; or with loaf sugar and lemon-juice, according to the condition of the patient for whom it is intended.

RICE JELLY.

Mix a quarter of a pound of rice, picked and washed, with ℔ss of loaf sugar, and just sufficient water to cover it. Boil till it becomes a glutinous mass; then strain and season with whatever may be thought proper.

BREAD JELLY.

Boil a quart of water and suffer it to cool. Take one-third of a sixpenny loaf of bread, slice it, pare off the crust, and toast to a light brown. Then put it into the water, place it on hot coals in a covered pan, and boil it gently, till you find, by putting some in a spoon to cool, that the liquid has become a jelly. Strain through a cloth, and set away for use. When it is to be taken, warm a teacupful, sweeten it with sugar, and add a little grated lemon-peel.

ARROWROOT JELLY.

Mix three tablespoonfuls of the best Bermuda arrowroot in a teacupful of water till quite smooth; cover it, and let it stand a quarter of an hour. Put the yellow peel of a lemon into a pint of water, and boil to one-half. Then take out the lemon-peel, and pour in the dissolved arrowroot, while the water is still boiling; add sufficient white sugar to sweeten it well, and let it boil together for five or six minutes. It may be sweetened, if thought necessary, with two teaspoonfuls of wine and some grated nutmeg. It may be boiled in milk instead of water, or in wine and water, according to the condition of the patient.

PORT WINE JELLY.

Melt ℥j of isinglass in a little warm water, stir it into a pint of port wine, adding ℥ij of sugar candy, ℥j of gum Arabic, and half a nutmeg, grated. Mix all well, and boil it ten minutes, or till thoroughly dissolved. Then strain through muslin, and cool.

TAPIOCA JELLY.

Take of tapioca, two spoonfuls, water, one pint; boil gently for an hour, or until it assumes a jelly-like appearance. Add sugar, wine, and nutmeg, with lemon-juice to suit the taste and the nature of the case. (This is improved by washing the tapioca well, and allowing it to steep for five or six hours, changing the water three times; then proceed as before.)

SAGO.

Wash in two or three waters, and let it soak for two or three hours. To a teacupful of sago, allow a quart of water, and some of the peel of a lemon. Simmer till all the grains look transparent. Then add wine and nutmeg, and boil together for a few minutes (or plain, with milk).

BARLEY WATER.

Wash clean some pearl barley, and to ℥ij of barley add one quart of water. Add a few raisins, or some lemon-peel and sugar, and boil slowly till reduced one-half. Then strain and sweeten. As nourishment in inflammatory diseases.

RICE-WATER.

Take of rice, ℥ij; wash it well, and add two quarts of water. Boil for an hour and a half, and then add sugar and nutmeg, as much as may be required. To be taken *ad libitum.* Mixed with milk, this is an excellent diet for children.

VEGETABLE SOUP.

Take one potato, one turnip, and one onion, with a little celery, or celery seed. Slice, and boil in one quart of water for an hour; add as much salt as is agreeable, and pour the whole upon a piece of dry toast. To be used when animal food would be improper.

INDIAN GRUEL.

Put three large tablespoonfuls of Indian meal, sifted, into a quart of water. in a large bowl; wash with several waters, turning off the water as the meal settles; then boil for twenty minutes, stirring all the while; add a little salt; then strain and sweeten, adding a little butter, wine, and nutmeg, if the case require. It should be taken warm. *Oatmeal Gruel* may be prepared in the same way; but if made of coarse grits, it should be strained, after boiling, and then seasoned.

PANADA.

Boil some slices of soft bread in a quart of water for five minutes. Then beat the bread smooth in a deep dish, mixing with it a little of the water in which it has been boiled; mix with it a bit of fresh butter, and sugar, and nutmeg, according to circumstances. Or, it may be made by grating some bread, or grating or pounding a few crackers; pour on boiling water; beat it well, and add sugar and nutmeg, or cinnamon.

BOILED FLOUR.

Take ℔j of fine flour, tie it up as tight as possible in a linen rag; dip it frequently in cold water, and dredge the outside with flour till a crust is formed on it. Then boil until it becomes a hard dry mass.

This may be grated and prepared in the same manner as arrowroot, for which it is an excellent substitute.

BEEF TEA.

Cut ℔j of lean beef into shreds, and boil for twenty minutes in one quart of water, taking off the scum as it rises—often cooling; strain. Very nourishing and palatable.

ESSENCE OF BEEF.

Put a pound of lean beef, thinly sliced and slightly salted, into a porter-bottle, or jar, closely corked. Place this in a vessel of cold water, and boil for an hour or more. Then decant and skim the liquid. Chicken tea may be made in the same way.

CHICKEN WATER.

Take half a chicken; strip off all the fat, and break the bones; add two quarts of water, boil for fifteen or twenty minutes, and season with salt.

MUTTON BROTH.

To one pound of lean mutton, allow one quart of water; season with a little salt, and some parsley, and put in some large pieces of the crust of bread. Boil slowly for two or three hours, skimming carefully. Beef, veal, or chicken broth may be made in the same manner. Vegetables, barley, rice, &c., can be added, if expedient. Mutton broth may be made more speedily, by taking three chops; beat the meat on both sides, and slice thin; put into a sauce pan with a pint of water, a little salt, and some crusts of bread, or some parsley, and a small onion sliced thin. Cover the sauce-pan, and boil fast; skim, and in half an hour it will be ready for use. It renders mutton broth more palatable to *broil* the chops before boiling.

INFUSION OF MALT.

Take the ground malt, Oj, hot water, Oiij. Infuse for two hours, and strain. Add sugar or lemon-juice if necessary.

WINE WHEY.

Boil a pint of milk, and, when boiling, add a large wineglass of Sherry or Madeira wine. Let it boil again, and then remove it from the fire and let it stand a few minutes. Then remove the curd, pour the whey into a bowl, and sweeten it.

RENNET WHEY.

Wash a small bit of rennet, about two inches square, in cold water, to remove the salt. Put it into a teacup, and pour on lukewarm water enough to cover it. Let it stand all night, and in the morning stir rennet water into a quart of warm milk. Cover it, and set it near the fire, till a firm curd is formed. Pour off the whey, and it will be found a very cooling and palatable drink.

CALVES' FEET JELLY.

Take two calves' feet, and add to them one gallon of water, which reduce, by boiling, to one quart. Strain, and, when cold, skim carefully. Add the whites of six or eight eggs, well beaten, a pint of wine, half a pound of loaf sugar, and the juice of four lemons, and let them be well mixed. Boil the whole for a few minutes, stirring constantly, and pass it through a flannel strainer. (Wine should be omitted in some cases.)

RICE GRUEL.

Take of ground rice, ℥j, cinnamon, ʒj, Water, Oij. Boil for forty minutes, adding the cinnamon near the conclusion. Strain and sweeten, and add wine if necessary.

BRAN TEA.

Take of fresh wheat bran, Oj, water, three quarts. Boil down one-third· strain, and add sugar, honey, or molasses, according to the taste of the patient.

LEMONADE.

Take of fresh lemon-juice, ℥iv, fresh lemon-peel, ʒss, white sugar, ℥iv, boiling water, three pints. Let them stand till cold, and then strain off for use. In fevers, a little spirits of nitre may be added.

TAMARIND WATER.

Put tamarinds into a pitcher or tumbler, till it is one-third full; then fill it up with cold water, cover it, and let it infuse for a quarter of an hour or more.

MOLASSES POSSET.

Put into a sauce-pan a pint of best molasses, a teaspoonful of powdered white ginger, and a quarter of a pound of fresh butter. Simmer on hot coals for half an hour, stirring frequently. Then stir in the juice of two lemons, or two tablespoonfuls of vinegar; cover the pan, and let it stand by the fire five minutes longer.

COCOA.

Boil two ounces of good cocoa in a quart of water, and as soon as it boils set it on coals to simmer gently for an hour or more. To be used hot.

TOAST WATER.

Toast some pieces of bread brown (not burnt), then put them into a pitcher, and fill it up with boiling water. Let it stand till cold, then strain it, and put it into a decanter.

Quantities of Opium contained in Different Preparations.

Linimentum Opii	gr. iij	in f ʒiv.
Pilulæ Saponis comp	gr. j	in gr. v.
Pilulæ Styracis comp	gr. j	in gr. v.
Pulv. Cretæ comp. c. opio	gr. j	in ℈ij.
Pulv. Ipecacuanhæ comp	gr. j	in gr. x
Pulv. Kino compositus	gr. j	in ℈j.
Tinctura Camphoræ comp	gr. j	in f ℥j.
Tinctura Opii	gr j	in ♏xix.
Vinum Opii	gr. j	in ♏xix.
Tinctura Iodinii comp. contains	gr. ij of Iodine	in f ʒj.
Unguentum Iodinii comp	gr. v	in ʒjss.
Unguentum Hydrarg. Fortius contains	ʒj of mercury	in ʒij.
Unguentum Hydrarg. Mitius "	ʒj "	in ʒvj.

TABLE

OF THE ALCOHOLIC STRENGTH OF WINES. BY CHRISTISON.

	Per cent. of absolute alcohol by weight.	Per cent. of proof spirit by volume.
Port, weakest	14.97	30.56
—— mean of seven wines	16.20	33.91
—— strongest	17.10	37.27
White Port	14.97	31.31
Sherry, weakest	13.98	30.89
—— mean of 13 wines, including those very long kept in cask	15.37	33.59
—— strongest	16.17	35.12
—— mean of 9 wines very long kept in cask in the East Indies	14.72	32.30
Madre da Xercs	16.90	37.06
Madeira, strongest } kept long in cask in East Indies	14.09	30.86
—— weakest } kept long in cask in East Indies	16.90	36.81
Teneriffe, long in cask at Calcutta	13.84	30.21
Cercial	15.45	33.65
Dry Lisbon	16.14	34.71
Shiraz	12.95	28.30
Amontillado	12.63	27.60
Claret, a first growth of 1811	7.72	16.95
Chateau Latour, first growth of 1825	7.78	17.06
Rosau, second growth of 1825	7.61	16.74
Ordinary Claret, a superior "vin ordinaire"	8.99	18.96
Rives Altes	9.31	22.35
Malmsey	12.86	28.37
Rudesheimer, superior quality	8.40	18.44
—— —— inferior "	6.90	15.19
Hambacher, superior quality	7.35	16.15
Giles' Edinburgh ale, before bottling	5.90	12.60
The same ale two years in bottle	6.06	13.40
Superior London Porter, four months bottled	5.36	11.91

The results of the above table were obtained by distillation, which was applied with such contrivance for accuracy, that nearly the whole spirit and water were distilled over without a trace of empyreuma, and without the loss of more than between two and six grains in 2000. From the quantity and density of the spirit, the *weight* of absolute alcohol of the density 793.9, as well as the *volume* of proof spirit of the density 920, was calculated from the tables of Richter, founded on those of Gilpin. Dr. Christison remarks that the alcoholic strength of various samples of the same kind of wine bears no relation whatever to their commercial value, and is often very different from what would be indicated by the taste even of an experienced wine-taster.

TABLE

Showing the Difference between Minims, Drops, and Grains of various Medicinal Liquid Preparations of the Pharmacopœia of the United States, &c. (From *Edwards and Vavasseurs'* "*Manual of Materia Medica,*" edited by Drs. Togno and Durand.)

	No. of drops in 20 minims.	No. of minims in 20 drops.	No. of drops in 20 grains.	No. of grains in 20 drops.
Sulphuric acid	30	13.3	25	16
Sulphuric ether	50	8	60	6
Rectified alcohol	46	8.6	57	7.1
Nitric acid	28	14.2	22.2	18
Acetic acid (crystallizable)	40	10	40	10
Muriatic acid	18	22.2	18.1	22
Oil of wormseed (*Chenop. Anthel.*)	40	10	50	8
—— peppermint, of aniseed... —— sweet almond, olive, palma christi	40	10	43.5	9
—— cloves	40	10	36	11
—— cinnamon	40	10	32	12.5
Copaiba	40	10	40	10
Diluted alcohol	40	10	42	9.5
Tincture of hydriodate of potassa, cantharides, kino, digitalis, assafœtida, sulphuric acid, colchicum, opium, valerian, guaiacum	40	10	43	9.3
Tincture (volatile) of valerian, of guaiacum	40	10	50	8
Tincture of muriate of iron	44	9.1	50	8
Wine (Teneriffe)	26	15.3	25	16
—— (antimonial)	24	16.6	25	15.3
—— of opium (Syden. laudan.)	26	15.3	29	13.7
—— of colchicum root —— of colchicum seeds	25	16	29	13.7
Vinegar (distilled)	19	21	20	20
—— of opium (black drop).. —— of colchicum —— of squill	26	15.3	25	16
Water (distilled)	15	26.6	17.5	24.5
—— solution of hydrocy. acid.*	15	26.6	17.5	24.5
—— solution of sulphuric acid (1 to 7)	17	23.5	17	23.5
—— solution of nitric acid, do	17	23.5	17	23.5
—— solution of ammonia (strong)	18	22.2	18.5	22
—— solution of ammonia (weak)	15	26.6	20	20
—— solution of hydriod. potas	18	22.2	20	20
—— solution of arsenite of potas.	19	21	20	20

* Prepared according to the process of the London Apothecaries' Hall.

PART VI.

SURGERY.

PART VI.—SURGERY.

Inflammation.

What is Inflammation ? It is a condition of hyperæmia, or of too much blood in a part, with its motion partly increased, and partly diminished.

What are the *symptoms* of inflammation ? Unusual *redness*, *heat*, *swelling*, *pain ;* and the function of the part is also perverted or arrested.

The *redness* is produced by an increased quantity of blood, or a relatively increased quantity of the red corpuscles, or both together. The hue and degree vary according to the intensity, and with the tissues affected ; and are permanent.

Heat is produced by the increased quantity of blood, and the more rapid oxidation of the tissues.

Swelling depends upon increased quantity of blood, and from effusion of lymph, serum, pus, &c.

Pain depends upon pressure upon the nerves, and the function of sensibility is also exalted. It is increased by pressure of the hand, or otherwise ; and varies with the part affected.

Sometimes these symptoms are not all present ; one of them may be absent, and yet inflammation exist.

How has inflammation been divided ? Into *acute*, *chronic*, *healthy*, and *unhealthy*.

How many *stages* are there of inflammation ? Two ; the *cold* and the *hot*. In the first there are coldness, languor, nausea, and a small, quick pulse. In the second, the skin is hot, pulse full and hard ; there is thirst, and the part becomes swelled and painful. It is not, however, always accompanied by constitutional symptoms.

What are the *results* of inflammation? There are eight: *resolution*, *adhesion*, *effusion*, *suppuration*, *ulceration*, *granulation*, *cicatrization*, and *mortification*, which constitute a series of stages in some cases.

What are the *causes* of inflammation? They are *chemical*, *mechanical*, and *vital*. Among the former are excessive heat, cold, cold and moisture combined, atmospheric air, noxious gases, acids, alkalies, blisters, rubefacients, animal poisons, contagious and specific diseases. Among the *mechanical* are contusions, lacerations, punctures, fractures, luxations, pressure, and numerous other agents.

Is every part of the body subject to inflammation? Nearly every part, but in an unequal degree; the liability is generally in proportion to the sensibility of the part.

How are the means of arresting inflammation divided? Into *constitutional* and *local*. Among the former, are *general blood-letting*, *purgatives*, *diaphoretics*, *mercury*, *opium*, *antimony*, and *low diet;* among the latter, are *topical blood-letting*, *blistering*, *cold*, *acetate of lead*, *tincture of iodine*, *nitrate of silver*, *rest*, *counter-irritation*, and *position*.

What objects are to be obtained by *constitutional* treatment? A reduction of the quantity and quality of the blood, by which it is rendered less stimulating, and a general sedative influence is produced upon the system. Some of the means which operate constitutionally also act by derivation or revulsion.

Suppurative Inflammation.

What are the symptoms of *suppuration?* The redness assumes a brighter hue, the swelling increases, becomes pointed and softer, pain is increased, and there is a sensation of pulsation and throbbing. Rigors or shivering often occur, and are looked upon as a sure indication that pus is formed, or about to be.

When the pus is once formed, pain and redness diminish, the swelling fluctuates, and a cavity usually exists, which encloses the matter, and is called an *abscess*.

What are the characteristics of *healthy* or *laudable* pus? It is of a light yellow or cream color; made up of small globules which float in a watery fluid.

Unhealthy pus is called *ichor* when it is thin and acrid. *Sanies*, when it is mixed with blood. *Sordes*, when it is of a leaden color, thick, and offensive. *Malignant*, when generated in pestilential diseases. *Contagious*, when it has the power of producing a disease of the same character. *Sero-purulent*, or *muco-purulent*, when mixed with serous or mucous discharge.

What is the *treatment* of suppurative inflammation? If the patient has been much enfeebled by evacuations, we substitute a better regimen, employ tonics, mineral acids, and opium. As local means, we use fomentations and warm poultices. Poultices should be continued after the discharge of matter, unless it is kept up too profusely, when other mild dressings should be employed.

What rules should govern us in regard to opening abscesses? Abscesses, where the matter is widely diffused, when it produces great pain, when its presence is likely to occasion additional harm in any way, such as by bursting into any cavity, laying bare a portion of bone, or of a large vessel, or by burrowing under fascia a great way before its arrival at the surface, and when situated on the face, or near joints, should be opened early. In other cases, they should be left longer. The best instrument for opening them is a narrow, sharp-pointed bistoury, which should be passed in slowly until you find by the feel that it is in the sack; then cut forward so as to make a free incision.

The part at which the opening should be made usually, is where there is the greatest *fluctuation*, or where *pointing* occurs; some times it is necessary to open at the most depending part, even if fluctuation should not be so evident in that position. If the edges after being opened, tend to unite, a tent should be introduced.

Ulcerative Inflammation.

What is meant by ulcerative inflammation, or ulcerative absorp tion? It is that morbid process by which the continuity of the different textures of the body is destroyed.

What parts of the body are liable to ulceration? Every texture is liable; but the skin, mucous membranes, and cellular tissue, suffer more readily than other parts. Pain always attends this process, and is generally lancinating.

Mortification.

What is mortification? *Gangrene* is that condition which immediately precedes the destruction of a part. *Sphacelus* denotes the complete death of a part; and the term *mortification* designates both stages of the complaint.

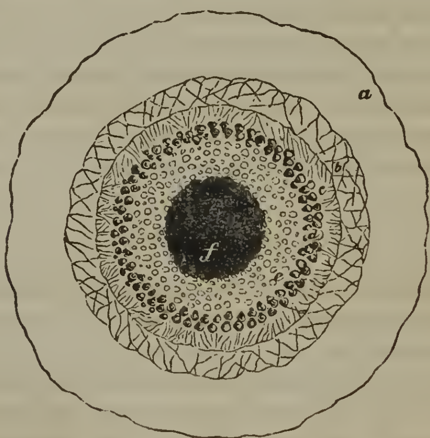
What are the different *kinds* of gangrene? They are the *humid* and *dry;* and the *idiopathic* and *traumatic.*

The idiopathic is constitutional, and the traumatic results from an injury.

What are the *causes* of mortification? It is generally the result of inflammation. It may be caused also by poisons, a deficient supply of arterial blood, any cause which will enfeeble the circulation, pressure, deposits in the arteries, ergot, &c.

What are the *symptoms?* The part loses its sensibility, heat, and color. These changes seldom take place suddenly, but are preceded by an increase of pain and swelling; the blood circulates only in the larger vessels; the skin becomes soft, and of a dark-red or purple color, and vesicles containing a thin serum are formed under the cuticle. When it is complete, if you press upon the part

Fig. 1.



Horizontal section of a Part Mortified.—*f.* Slough, or mortified tissue. *e.* Pus. *d.* Granulations, or reparative surface. *c.* Circumscribing fibrinous septum. *b.* Effused serum in cellular tissue. *a.* Unaltered healthy structure.

the blood will not return. Along with these symptoms the pulse becomes quick and tremulous, of a typhoid character, tongue dry and brownish, skin hot, the patient restless, uneasy, and frequently with delirium, subsultus, nausea, and hiccup. If sufficient power exists in the system, nature makes an effort at separation. The living part in contact with the dead becomes inflamed, a *line of demarcation* is thus formed, at which point ulceration and suppuration take place, and the *line of suppuration* is developed.

What is the *treatment?* When there is high inflammation which is likely to terminate in gangrene, the antiphlogistic treatment should be adopted; but if gangrene has taken place, a different practice must be pursued. The bowels should be gently opened, and tonics, and nutritious food given. Opium, carbonate of ammonia, camphor, &c., will be found beneficial. Local remedies are of use only where the mortification is incomplete; when scarifications, emollient poultices, blisters, &c., have been recommended. In *senile gangrene*, opium is an important remedy. To prevent sloughing or bed-sores, from long confinement, the parts, when they are first discolored, should be washed with a solution of nitrate of silver, 10 grs. to ℥j of water, 3 or 4 times a day, then covered with bland adhesive plaster. The hydrostatic bed is highly recommended by Dr. Mussey, as a preventive. Where the sores have formed, dress with adhesive plaster, and change the position of the patient.

Amputation is seldom resorted to in cases of mortification before a line of separation is formed, although it is sometimes in traumatic gangrene; but it should never be in the idiopathic variety.

What are the symptoms of *dry mortification?* The toes and feet lose their heat, and become shriveled, discolored, and converted into a hard, dry, insensible mass, of a dark-blue or black color, without previous swelling, redness, pain, or fetor.

What is the *treatment?* *Amputation.*

Erysipelas.

What are the *symptoms* of erysipelas? The surface of the part affected is elevated, varies from a bright scarlet to a purplish color, has an abrupt termination, and is accompanied with a burn-

ing or itching sensation. There is generally more or less rigor, fever, nausea, &c., preceding the complaint. The symptoms are sometimes slight, and sometimes very severe, particularly in the epidemic form, and when it attacks the head and face.

What are the *causes* of erysipelas? The causes are not always obvious; in other cases, it may be traced to the application of poisons, wounds, exposure, foul air, derangement of the digestive organs, &c.

What is the *treatment*? In the commencement, if indicated by the general symptoms, recourse should be had to blood-letting, purgatives, diaphoretics, and low diet. Sometimes a contrary plan becomes necessary during the course of the disease, and opium, bark, camphor, &c., may be indicated. The local remedies in use are collodion, tincture of iodine, sulphate of iron, nitrate of silver, and acetate of lead in solution; incisions, mercurial ointment, British oil, starch, flour, &c. The nitrate of silver, applied with a pencil so as to surround the inflammation, is frequently resorted to.

Furunculus, or Boil.

What are the *symptoms* of furunculus? It is a hard, painful, and highly inflamed tumor, conical, base below, and apex above the level of the skin; and contains a disorganized mass, called a core.

What is the *treatment*? Encourage suppuration with warm poultices, and as soon as the apex becomes soft, make an opening into it large enough to remove the core.

Anthrax, or Carbuncle.

What are the *symptoms* of anthrax? It is a deep-seated, circumscribed, hard, and painful swelling, of a livid hue, attended with itching and a burning heat, and terminates by sloughing. The constitutional symptoms are often very severe, particularly loss of appetite, fever, prostration, &c. When on the scalp, they nearly always prove fatal.

What is the *treatment*? Emollient poultices in the first stage, until vesication, or a discharge of bloody serum, appears; it should then be freely covered with caustic vegetable alkali, as

recommended by Dr. Physick. Other surgeons recommend that it should be opened early by free incisions, and stimulating applications used. Opium should be freely employed to assuage pain and procure sleep.

Pernio, or Chilblain.

What are the *symptoms* of pernio? It is the result of cold, and is met with in the extreme parts of the body. At first the skin is pale and shrivelled, which is succeeded by redness, tumefaction, pain, pruritus, and œdema. In severe cases, the skin becomes purplish, the itching very violent; vesication takes place, and forms an ill-conditioned sore. The mild form frequently disappears in summer, and returns in the winter.

What is the *treatment?* The application of soap liniment, spirit of turpentine, sulphate of copper, and tincture of cantharides is recommended. The best remedy is to smear the part with the balsam of copaiva. Nitrate of silver is also a useful application.

Frostbite.

What are the *symptoms* of frostbite? The exposed part becomes benumbed, stiff, and insensible; these symptoms are succeeded by heat, swelling, pain, lividity, and by suppuration, which occurs between the sound and living parts. When the cold is long continued, so as to affect the internal organs, drowsiness, shivering, rigidity of the limbs, diminution of the circulation, and profound sleep, terminating in death.

What is the *treatment?* Snow and ice water should first be applied, and the parts carefully handled; when the natural temperature is restored, it should be treated according to the circumstances of the case in regard to inflammation, tendency to mortification, &c. When the patient is insensible, the indications are to restore the respiration and circulation by sternutatories, volatiles, frictions, &c.

Burns.

How are burns *divided*, and what are their *symptoms?* They are divided into *superficial*, *ulcerated*, and *carbunculous*. In the first, there is simple erythema; in the second, vesication; and the third is where the cutis and adjoining parts are disorganized,

with severe constitutional disturbance in proportion to the extent of the injury. In the second variety, the constitutional disturbance may be great also, in proportion to the extent of surface involved.

At what period may burns prove dangerous? When the shock is first received; from reaction or inflammation; and at the suppurative period.

What is the *treatment?* In superficial burns, the application of carded cotton is highly extolled; also cooling applications, either by the direct application of cold, or by evaporating lotions. The essence of peppermint, before vesication takes place, is one of our best applications to assuage pain, and prevent the effusion of serum.

In the second variety, emollient applications should be used, and a liniment of lime-water and flaxseed oil, or sweet oil, spread on cotton batting, is as good an application as we can make. In the third variety, the stimulant plan, internally and externally, should be adopted, until reaction takes place, when the antiphlogistic system may become necessary. Opium is generally necessary to relieve pain and constitutional disturbance. Dry flour is a good local application in all forms of burns.

The after-treatment of ulcers should be governed by the circumstances of the case, always bearing in mind the strong tendency to contraction of the cicatrices, which should be counteracted by splints, rollers, &c. The treatment of these cicatrices has been recently much improved by means of plastic operations.

Wounds.

How are wounds *divided?* Into *incised*, *punctured*, *penetrating*, *contused*, *lacerated*, *poisoned*, and *gunshot*. These may be divided into wounds of the *head*, *face*, *neck*, *chest*, *belly*, and *extremities*.

Incised Wounds.

What are the *dangers* of incised wounds? These are the least dangerous of the wounds except from hemorrhage, which may be troublesome when a sharp instrument is used, or large bloodvessels divided.

What is the proper *treatment?* It is to suppress the hemorrhage, clear the wound of all foreign matter, and retain the edges in contact. The object is to have them heal by *adhesion*, or *union by the first intention*, as it was formerly called. It is produced by the effusion of coagulable lymph, or fibrin, which becomes organized, and incorporates the cut surfaces together.

Another mode of healing is by *growth*, reparation being made, as in the ordinary nutritive process, without inflammation or suppuration.

The *modelling process* is similiar to this; the gap being filled up with lymph gradually.

Granulation is what has been termed *union by the second intention.*

What are the means of suppressing hemorrhages? *Ligatures, compression, styptics, cold, elevated position,* and the *actual cautery.* The tenaculum, needle, and forceps are the instruments employed to secure bleeding vessels. Ligatures are made of thread, silk, or leather. Compression may be performed by the tourniquet, by rollers and pledgets, or by tying a handkerchief around a limb and twisting it with a stick.

The actual cautery should never be employed when the bleeding vessels can be secured.

What are the means used for retaining the edges of the wound in contact? *Adhesive straps, bandages,* and *sutures*; the object of which is to produce adhesion.

There are two sutures in use; the *twisted* and the *interrupted.*

How is the *interrupted* suture formed? By passing a needle and thread through the skin and subcutaneous cellular texture, from without inwards on one side, and from within outwards on the other, at about one-fourth of an inch distance from the margin, and fastening the ends of the thread with sufficient tightness to prevent the surfaces from separating. They should be placed about an inch apart; and, of course, the proper number is proportioned to the size of the wound. The intervals should be supported by adhesive straps.

How is the *twisted* suture formed? By passing a common sewing-needle through the skin and other texture from one side of the wound to the other, and twisting a thread over each end of it in the form of a figure 8, with a sufficient degree of tightness to keep

the parts together; where several are used, the thread may also be passed from one needle to another. The points should then be clipped off. Needles composed of gold, silver, &c., have been recommended, but they possess no advantage over the common sewing-needle.

Punctured Wounds.

How are punctured wounds *produced?* By sharp narrow instruments, such as needles, pins, thorns, splinters of wood, nails, &c.

What are the *dangers* from punctured wounds? Tetanus, and large collections of matter under the fascia.

What is the *treatment?* A soft poultice is generally sufficient; but, if there are indications of the formation of matter, or nervous symptoms arise, the wound should be freely dilated, and kept open. The use of opium may become necessary.

Penetrating Wounds.

What are the *characteristics* of penetrating wounds? They are more extensive than punctures, and generally produced by the small sword, bayonet, or dirk.

What are the *dangers* from penetrating wounds? They may be dangerous from entering large cavities; injury to important blood-vessels, nerves, or viscera; or they may cause extensive collections of matter in deep-seated parts.

What is the *treatment?* The first object is to suppress hemorrhage, which may require extensive incisions. If the bleeding vessel is in the chest or abdomen, deep-seated, the plan is to diminish the general activity of the circulation by blood-letting. In other respects, they are to be treated as the constitutional and local symptoms may demand.

Contused Wounds.

What are the *dangers* from contused wounds? Gangrene is very liable to take place when they are extensive and severe.

What is the *treatment?* They should be treated on common antiphlogistic principles, locally and generally. Adhesion is not to be expected.

Lacerated Wounds.

What are the *dangers* of lacerated wounds? They are dangerous from their extent, and the parts involved. They bleed sparingly; but are liable to secondary hemorrhage and to gangrene, and do not heal by adhesion.

What is the *treatment?* Bring the parts as near together as possible, and treat the constitutional effects as the condition of the patient may demand.

Poisoned Wounds.

How are poisoned wounds *produced?* Generally by cuts in dissection, insects, serpents, rabid animals, &c.

What is the *treatment?* In the sting of bees or wasps, the local application of common salt, cold water, aqua ammoniæ, &c., are useful. In the bites of serpents, olive oil, aqua ammoniæ, arsenic, &c., have some reputation. The application of a cupping-glass to the part has proved useful When called early, the part should be removed entirely. In dissecting wounds, apply lunar caustic, after washing clean, and take a mercurial purge. The effects of inflammation may require attention on general principles.

Gunshot Wounds.

What are included under the head of gunshot wounds? All injuries occuring from firearms, explosion of shells, rockets, &c., and are of the nature of lacerated and contused wounds.

What circumstances render gunshot wounds *dangerous?* The extent of the injury, the parts involved, from their indisposition to heal by the first intention, their disposition to slough, and secondary hemorrhage.

What is the general *treatment?* It is to suppress hemorrhage, and extract the foreign body when it can be done without too much injury to surrounding parts, and attend to the general state of the system. The applications should be simple, such as water-dressings, with sugar of lead and opium. Amputation is frequently required.

ABSCESSES.

What is the *treatment* of *Abscess* of the *Antrum?* It is to remove one or more teeth corresponding with the floor of the antrum; if the matter is not then discharged, pass a stilet or small trocar into the cavity from where the tooth has been pulled, and push it into the antrum gradually. Use astringent injections four or five times a day, and keep a bit of bougie or tent in the opening until the discharge and inflammation subside.

What is the *treatment* of *Mammary Abscess?* The first step is to prevent them, if possible, by the repeated application of warm vinegar, topical blood-letting, and a general antiphlogistic course.

If we find suppuration must take place, apply warm poultices, and open in a depending part when fluctuation is perceived.

What are the *symptoms* of *Lumbar Abscess?* Pain in the lumbar region, extending from the kidney down to the outside of the thigh, testicle of the side drawn up, and pain in the spermatic cord. These are followed by rigors, loss of appetite, and hectic. It sometimes points below the groin, sometimes it passes through the ischiatic notch, and, in other cases, passes down near the rectum. The discharge is generally thin and gleety, mixed with small flocculi resembling curds or cheese.

What is the *treatment?* Very few recover. In the early stages, the antiphlogistic course should be adopted; but, when matter is formed, an opposite course should be pursued.

When the abscess is opened, it should be done by a small valvular incision, then closed for a time, and again opened, so as to draw off the matter in a gradual manner.

ULCERS.

How are ulcers *divided?* Into *healthy*, *unhealthy*, and *specific.* The first comprehends but one species, the simple ulcer. The second contains two species, the irritable and indolent ulcer. The third contains several species, the principal of which are ulcers from scrofula, cancer, fungus hæmatodes, syphilis, and syphiloid, scorbutic, herpetic, lupus, or noli me tangere, &c.

Simple Ulcer.

What are the *causes* of the simple ulcer? Injuries done to a sound part by wound, contusion, abscess, or burn.

What are the *characteristics* of a simple ulcer? It exhibits a florid appearance, owing to the small, pointed, and numerous bright-red granulations which cover it. There is a discharge of healthy pus in small quantity, and the tendency is to heal.

What is the *treatment?* Simply keep the part in a proper position, and cover the sore with some mild, fresh ointment, spread on lint or linen rag. Dry lint is also a good application.

Irritable Ulcer.

What are the *characteristics* of the irritable ulcer? The edges of the sore are ragged, undermined, and sometimes almost serrated. The parts beyond the ulcer are red and inflamed; the bottom of the ulcer exhibits irregular hollows, which contain a thin, greenish, or red acrid matter; and, in place of healthy granulations, may be found a dark-red, spongy mass, painful, and bleeding on the slightest touch.

What are the *causes* of the irritable ulcer? It proceeds from local causes, influenced by the state of the constitution and habits of the patient. The digestive organs in particular are generally disordered.

What is the *treatment?* The constitutional condition should be attended to; and, if the digestive organs are affected, resort should be had to steady purging and antimonials, if not contra-indicated.

The proper local applications are poultices, fomentations, cream, a weak solution of the nitrate of silver, and opium mixed with poultices, or sprinkled over the sore. The limb should be elevated, and pressure and bandaging avoided.

Phagedænic ulcer is irregular in form, edges ragged and abrupt, surface uneven and brown, pain burning, and constitutional disturbance generally great. More or less sloughing usually occurs, and the extension is rapid.

Constitutional and local treatment are both necessary. Correct the secretions, allay irritation, and invigorate the system with fresh air and good diet. Apply nitric acid, nitrate of mercury,

&c.; then poultices, solutions of chloride of lime or soda, &c. Mercurials are inadmissible.

Indolent Ulcer.

What are the *symptoms* of the indolent ulcer? The granulating surface has a flat, shining aspect, and is partly covered with a pellicle or crust of a whitish or dark-gray color. Sometimes the surface is dry, but generally there is a discharge of a viscous cohesive fluid. The edges are elevated, smooth, and rounded; beyond the ulcer the parts are swollen and indurated. The pain is trifling.

What is the *treatment* of the indolent ulcer? Where an ulcer shows a disposition to become indolent, resort should be had without delay to escharotics, adhesive straps, or the roller. If these

Fig. 2.

do not effect a cure, the edges should be pared away, and the whole surface pencilled with the vegetable or lunar caustic. The oak-bark poultice, followed in a few days by the adhesive strips or roller, will sometimes cure. These ulcers frequently require stimulating applications, such as lunar caustic, savine powder, cantharides, capsicum, corrosive sublimate, &c. Dr. Physick considered a combination of ℥j of simple cerate, and ʒij of British oil as the best cicatrizer. The dressings should be changed repeatedly.

Constitutional remedies also exert a powerful influenee, and such remedics as blue-pill, and other mereurials, should be resorted to.

In healing chronic ulcers, care should be taken to establish an issue in some part of the body; otherwise, the stoppage of a long-established discharge may give rise to apoplexy, or other serious disturbanee.

Varicose ulcers will usually heal with adhesive straps, the roller, or laced stocking; but in many instances the enlarged veins can only be relieved by an operation.

Ulcers should not be healed when they have been stationary for years, and the patient is old, gouty, or a high liver. Their continuance may act as a safety valve in preventing the occurrence of some serious disease.

Scrofula.

What are the *premonitory signs* of scrofula? A delicate complexion of a lively-red eolor, mixed with a clear white, the lips red, and the upper one especially thick and protuberant. The pupils of the eyes large, and the conjunctiva free from vessels. These are some of the symptoms whieh denote the serofulous constitution.

Children are more subject to it than adults.

What are the *symptoms* of serofula? A scrofulous tumor is first a simple enlargement without pain, or unnatural heat; in a short time, it beeomes tender on pressure, and the heat is augmented; inflammation then generally sets in, and it terminates in abscess and ulceration, but not always. The matter discharged from abscesses of this kind is thin, gleety, and mixed with flocculi.

What are some of the most obvious *causes* of scrofula? Cold and moisture, hereditary influence, irregularities of diet, meagre and unwholesome provisions, an impure or tainted atmosphere, deficient clothing, fevers, filth, fatigue, mental anxiety, &c.

What is the proper *treatment* for serofula? Invigorate the general system by a light nourishing diet, tonics, and such other means as the general state of the health may require. Flannel should be worn next the skin, and moderate exercise persevered in. Iodine and its compounds, both generally and loeally, are valuable in the treatment of most cases of scrofula. Cod-liver oil has been found of much value in this disease.

For the scrofulous ulcer, dry lint, the iodine cataplasm, astringent washes, and moderate pressure, are recommended.

Gonorrhœa.

What are the *symptoms* of gonorrhœa? They are a slight titillation of the glans penis, tumidity of the lips of the urethera, and more or less inflammation of the glans and prepuce. These are followed by a discharge from the urethra of a thin whitish fluid, speedily changing into a yellow purulent matter, of peculiar smell, attended with pain along the course of the urethra in discharging the urine.

It consists of an acute inflammation of the lining membrane of the urethra, caused by the application of matter from another during the sexual connection. The time of its appearance is variable. *Chordee* sometimes occurs, in which there is erection with great pain, and the penis is bent, with the concavity downwards, in consequence of the effusion of lymph into the corpus spongiosum urethræ, preventing its expansion.

Various other complications may occur, such as phymosis, paraphymosis, excoriation, bubo in the groin, abscess in the perineum, swelling of the testicles, and pains in the joints.

What is the *treatment?* The *abortive* plan of treatment has been recommended by some, prior to the suppurative stage, by injecting a strong solution of the nitrate of silver, with a glass syringe, into the urethra. The constitutional treatment in severe cases is rest, blood-letting, purgatives, and low diet. Stimulating diuretics, especially balsam of copaiva and cubebs, are beneficial. When the ardor urinæ and discharge diminish, we may use astringent injections, which should be very mild.

Syphilis.

What is understood by the *syphilitic virus?* It is a specific morbid poison, which, applied under certain conditions to any portion of the human body, will there determine definite and characteristic local phenomena, and, if absorbed, contaminate the system.

How is syphilis *divided?* Into *primary* or *local*, of which chancre is the exponent. And *consecutive*, *general*, or *constitutional*, which is always the consequence of chancre.

What is *chancre?* It is a primary venereal sore, produced by the direct action of the syphilitic virus on the inoculated part.

What are the different ways that chancres may be developed? By pustule, ulceration, and small abscess.

What are the stages? There are two; one of ulceration, and the other of cicatrization.

What is the difference in the properties of the matter in these two stages? In the first it is inoculable, and in the second it is not.

How are chancres divided as to *location?* Into *external* and *larvated*, or *concealed.*

How are they divided in regard to their characteristics? Into *follicular*, *indurated*, *phagedænic*, and *furunculous.*

What is the index of constitutional affection? Induration of a chancre.

Are *buboes* classed among the primary or secondary symptoms of syphilis? The primary; and may occur both from sympathy and absorption. If from absorption, they are inoculable, and are included in the term furunculous chancres, or chancrous buboes.

What is the *treatment* of chancre? As it is at first purely a local affection, the specific sore should be converted into a simple one by the application of caustic. Nitrate of silver, protonitrate of mercury, sulphate of copper, potassa cum calce, &c., are used for this purpose, some preferring one, and some another. After the separation of the eschar, simple dressings, such as weak solutions of sulphate of copper, black and yellow washes, aromatic wine, &c., will be proper dressings. Larvated urethral chancres may be cauterized by Lallemand's instrument.

How should buboes from *absorption* be treated? By antiphlogistics generally; leeches, blisters, succeeded by a solution of corrosive sublimate, and other antiphlogistic applications locally; after ulceration, they should be treated like chancres. When suppuration takes place, they should be opened early.

What is the proper *treatment* for chancre when it becomes indurated? Induration being the index of absorption, which is followed by constitutional symptoms, constitutional remedies become necessary, and mercury, pushed to the extent of a very slight impression on the glands, is the best remedy.

What are the *constitutional*, or *secondary* symptoms? Cutane-

ous eruptions, inflammation of the eye, inflammation and ulcerations of the palate and fauces, induration and ulcerations of the glands of the skin, inflammation of the osseous and fibrous tissues, neuralgia, &c.

Are these affections capable of hereditary transmission? They are; but the primary are propagated from one to another only by inoculation.

What is the *treatment?* By alteratives; among which mercury stands first; iodide of potassium, sarsaparilla, arsenic, &c., are also useful.

TUMORS.

What is understood by a Tumor? A swelling or new production, and not a part of the original composition of the body.

How are tumors *divided?* Into *solid* and *encysted.* The solid are generally enveloped by a dense cellular sheath of surrounding cellular substance, which divides them from surrounding parts. Others, however, have no such limit, and involve surrounding parts as they enlarge.

What is understood by *Adipose Tumors?* They appear to be composed of fatty matter insinuated amongst extended and delicate cellular substance; generally lobulated, and fonnd only in the cellular and adipose tissues.

What is understood by *Fibrous Tumors?* They are formed in various textures, are composed of a substance of a dirty-gray color, with considerable density, through which firm ligamentous bands ramify. They do not mingle irregularly with surrounding parts; thus differing from malignant tumors which contain fibrous matter.

What is understood by *Encephaloid Tumors?* They are decidedly malignant, and called Encephaloid, or Medullary Sarcoma. They are not like brain or spinal marrow in their intimate structure, as the name might indicate; perhaps *fungoid* would be a better term. They consist of a homogeneous matter, resembling the substance of brain in color and consistence; always soft, but more so in some parts than in others; general softening occurs in advanced stages. The mammæ, testicle, and contents of the orbit in children, are the parts most liable to this disease.

What is understood by *Melanoid Tumors?* They are of rare

occurrence, originate in the cellular tissue, and most frequently attack the viscera, sometimes the eyeball. The external appearance is generally shining and mottled; internally, they consist of a homogeneous black matter, infiltrated into the cellular tissue. Occasionally they are firm, in other cases soft, broken down, and semifluid.

What is understood by *Carcinomatous Tumors?* They are the most malignant and intractable of tumors. The term *scirrhus* is often used synonymously with carcinoma, while *cancer* is a term pretty indiscriminately employed to denote their condition after ulceration. They are characterized by a preternatural density or induration of the soft parts, difficult of resolution, and prone to ulceration. Unequal in surface, uncommonly heavy, and the skin covering them puckered, and of a faint blush or leaden hue; with a vehement, peculiar, lancinating pain in the part. Their internal structure contains firm ligamentous bands, traversing in various directions, and communicate a grating feel to the knife when cutting them.

What is understood by *Fungus Hœmatodes?* It is a term applied to those fungous growths which have hemorrhage proceeding from them to a greater or less degree, and with more or less frequency. The term is often applied to medullary sarcoma.

What is understood by *Encysted Tumors?* They are superficial, consist of an external cyst, which is sometimes thin and delicate, in other cases dense, thick, and fibrous, or almost cartilaginous. The internal structure varies very much in different cases. They are sometimes designated from the nature of their contents: *Atheromatous*, containing curdy matter; *Melicerous*, containing a substance like honey; and *Steatomatous*, containing fatty matter. It is difficult, however, to thus designate them all properly.

What is the proper *treatment* for tumors? Extirpation with the knife is the only remedy to be depended upon; and even this will often fail when the tumor is malignant, although it gives the best chance for success.

Fractures.

How are Fractures *divided?* Into *simple*, *compound*, and *complicated*, and again into *transverse*, *oblique*, *comminuted*, and *longitudinal*. A *simple* fracture is a mere separation of the bony

fibres, unattended with severe contusion or external wound. A *compound* fracture is accompanied with an external wound or protruded bone. It is called *complicated* when the bone is broken in more than one place, combined with luxation, laceration of large vessels, or rupture of ligaments, tendons, &c., or other extensive injury. A fracture is *transverse* when its direction is perpendicular to the axis of the bone, *oblique* when it deviates from the perpendicular direction, *comminuted* when the bone is broke in several places, and *longitudinal* when it runs parallel with the axis of the bone.

What are the *symptoms* of fracture? Generally there is crepitus, and when it exists can be relied on. There is also usually deformity, pain, swelling, and inability to use and move the limb. Bones in young subjects are sometimes bent, only a few of the bony fibres on the convexity giving away.

What is the *prognosis* in fractures? It will depend much upon the extent of the injury, constitution, and age of the patient, the kind of fracture, and the bone broken. Complicated and compound fractures are the most dangerous. An oblique fracture is more difficult to manage than a transverse one, owing to muscular contraction.

What is the *treatment* for fractures. The general indications are to prevent or subdue inflammation, and to coaptate and retain the fragments in contact, until they are restored by callus.

The former is best accomplished by the antiphlogistic course and position; and the latter by extension, counter-extension, position, splints, compresses, and bandages. It requires from two to eight weeks to produce consolidation, and sometimes longer, before complete restoration takes place.

Fracture of the Lower Jaw.

What are the *symptoms* of fracture of the lower jaw? Crepitation can generally be detected, and the teeth will be found irregular, and often loosened. It generally occurs in the mental region, or middle of the horizontal ramus; but it may occur in any part.

What *apparatus* is necessary? A compress, and a bandage united in the centre and divided at each end, near to the middle, so that each loose end may be tied to the one of the opposite side; one of them over the top, and the other at the back part of the

head; the united portion of the bandage covering the compress and fracture.

Fig. 3.

The patient must be nourished with broth or other thin fluid, imbibed between the teeth.

Fracture of the Vertebræ.

What are the *symptoms* of fracture of the vertebræ? It is rare, and when it does occur, must be the result of great violence. Diagnosis is sometimes difficult, as paralysis may occur from concussion without fracture. If it occur above the fourth cervical vertebra, death takes place at once, from injury to the phrenic nerve.

If immediately below the fourth, the upper extremities are paralyzed, there is difficult respiration, and death occurs in a few days.

When the dorsal vertebræ are the seat of fractures, paralysis of the lower extremities, and intestinal torpor occur, with gaseous distension, and death in a few weeks or sooner.

If it be the lumbar vertebræ, the bladder and rectum are paralyzed, and the urine and feces pass involuntarily, the lower extremities are paralyzed, and death follows sooner or later.

Fractures of the spinous processes are not serious, unless accompanied by concussion, or some other injury.

Prognosis is unfavorable.

What is the *treatment* for fracture of the vertebræ? If the patient should survive the immediate effect of the injury, the antiphlogistic course should be adopted, particularly one to relieve inflammation of the spinal marrow; and the urine must be drawn off frequently by the catheter.

Fracture of the Ribs.

What are the *symptoms* of fracture of the ribs? They are not always distinct unless crepitus exists; there is generally little displacement; but usually pain on respiration (especially in the recumbent posture) at the seat of the injury, which is increased upon coughing.

What is the *treatment?* A roller 6 or 7 inches wide should be applied tightly round the breast, so as to cause the patient to breathe by the diaphragm. The general symptoms should be attended to at the same time.

Fracture of the Sternum.

What are the *symptoms?* An incessant grating of the fragments upon each other during respiration. The direction of the fracture is commonly transverse.

What is the *treatment?* The indications are to prevent or subdue inflammation, and to appease the incessant cough and difficult respiration that usually attend. A roller should be applied also, as in fracture of the ribs, and a compress if necessary.

Fracture of the Clavicle.

What are the *symptoms?* Crepitation, depression of the humeral beneath the sternal fragment, the shoulder falling below the level of the opposite one, and the peculiar inclination of the head and body towards the affected side.

What is the *treatment?* The indications in fracture of the clavicle are to carry the shoulder upwards, outwards and backwards; and to retain it in this position by appropriate apparatus, of which there is a variety in use, some surgeons preferring one, and some another. The plan of Velpeau is recommended by Prof. Mussey, in which the forearm is brought across the chest, with the hand resting on the shoulder of the sound side, and secured in this position by proper bandages and compresses.

"The last and best apparatus is that of Dr. Fox, which consists in a sling for the elbow, made of stout linen, or other material; this should be in length about two-thirds of the forearm, and deep enough to embrace the forearm; it can easily be made out of a piece of stuff, cut into a parallelogram twice the width of the forearm, and two-thirds of its length; this is to be doubled in its

shortest diameter, and one end sewed up; at the upper angle, and the corner of each side, a strong loop of tape is attached. A ring of linen, stuffed with carded cotton, is made to embrace the shoulder and axilla; a wedge-shaped pad, which should be three inches thick at the base, six inches long, and four or five wide; three strong pieces of tape or bandage complete the apparatus. The application of it is as follows: The base of the pad is placed in the axilla of the injured side, and temporarily secured by being held, or by tapes tied around the neck; the arm of the sound side is passed through the padded ring, which rests in the axilla and over the shoulder: the sling is applied to the forearm, the elbow

Fig. 4.

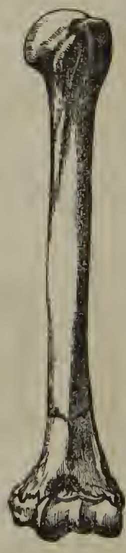
placed firmly in its angle, and the arm is now brought down to the side, the fracture coaptated; tapes having been passed through the loops attached to the sling, are now carried through the ring at the sound shoulder, the tape at the elbow carried behind the chest, and those at the wrist in front; these are firmly drawn so as

to place the shoulder and clavicle in proper position, the hand being put into a sling. Raw cotton should be placed under the tapes where they touch the skin, to prevent excoriation. With this apparatus I have treated a child only twenty months old without inconvenience or deformity, but it is necessary to avoid much pressure in such young subjects, as well as to exercise great care in protecting the skin from excoriation; in this case, a few circular turns of a roller were passed round the chest and forearm to prevent motion — an addition unnecessary in the adult. This apparatus is easily applied; and can be worn without inconvenience, and probably answers the indications better than any that has yet been proposed."—*Hastings' Surgery.*

Fractures of the scapula can generally be treated by the same position and apparatus as those of the clavicle.

Fig. 5.

Fig. 6.



Fracture of the Arm. (Figs. 5 and 6.)

What are the *symptoms?* Crepitation, mobility of the fragments, and angular displacement, or a tendency to it. A fracture

of the neck of the humerus, besides the ordinary symptoms of fracture, may be distinguished from dislocation by the rotundity of the shoulder being preserved; while in dislocation there is a hollow under the acromion, and a tumor in the axilla.

What is the *apparatus* necessary for the treatment? A long roller and four narrow splints, when the shaft is the seat of fracture.

When the condyles are fractured, a roller and two angular splints are necessary.

When fracture of the lower extremity of the humerus occurs just above the condyles, much care is necessary to distinguish it from dislocation of the radius and ulna backwards. In fracture, crepitation may be produced; the deformity is easily removed by extension, and returns when discontinued, and the length of the arm is shortened, which is not the case in dislocation.

Fig. 7.

The roller and angular splints are also appropriate for this injury; one splint should be placed in front and the other behind the arm, with the horizontal limbs of the splints resting upon the upper and lower surfaces of the forearm, and attached to it by the roller.

Fracture of the Forearm

What are the *symptoms?* Crepitation, deformity, and the mobility of the fragments.

Both bones may be fractured upon the same level, or at different points, or one bone alone may be fractured; the radius being more frequently broken than the ulna.

Fig. 8.

Fig. 9.

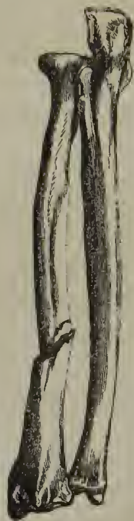


Fig. 10.

The *olecranon* process of the ulna may be fractured by direct violence, or by the action of the triceps muscle.

The *coronoid* process is sometimes, although rarely, fractured.

When the coronoid process is broken, there is dislocation of the ulna backwards, with the characteristic projection, and difficulty of bending the elbow.

Fracture of the lower end of the radius may easily be mistaken for dislocation of this bone at the wrist-joint, and great caution should be observed in making a diagnosis.

In fracture, crepitus may be produced, and the deformity is easily removed by pressure, and returns when left free.

What *apparatus* is necessary in the *treatment?* Two long compresses; two splints 2½ inches wide, and long enough to extend from the elbow to the points of the fingers; and a roller.

Fig. 11.

The soft parts of the interosseous space should be made to serve as a splint, by the arrangements of the compresses, so as to force the fragments outwards, and keep them in apposition.

If this precaution should be neglected, pronation and supination may be destroyed, as may be seen by Figure 12.

Fig. 12.

Fig. 13.

In fracture of the *olecranon*, the elbow should be straightened and bandaged by circular and reversed turns of a roller from the hand to the injured joint; the fragment should be brought down and adjusted, the roller passed above it and around the joint, in the form of figure of 8, until is it firmly fixed. (Fig. 13.) A splint

is then to be placed in front of the joint, of some length, and secured by a roller. In three weeks the joint should be moved passively so as to prevent anchylosis. The union will be ligamentous.

In fracture of the *coronoid process*, the joint must be put in proper position, bent at right angles, bandaged properly, and placed in a sling.

Fractures of the *carpus*, *metacarpus*, and *phalanges* require no special directions; general principles in reference to fractures governing in all cases.

Fracture of the Patella.

What are the *symptoms?* The transverse fracture, which is the most common, is known by the upper half being remove upwords on the thigh, and the patient is unable to rise or to walk.

Fig. 14.

What is the *treatment* and *apparatus?* The limb should be placed in an extended position and flexed on the pelvis. The apparatus is a splint two inches wide, long enough to extend from the tuberosity of the ischium to near the heel; two rollers, each six yards long, and three inches wide; and compresses.

Pass the roller by circular and reversed turns from the foot to the lower fragment; bring the upper one down in contact with the lower; pass the roller around the knee in the form of the figure of 8, and with circular turns in such a manner as to retain the fragments in contact. The roller should be passed so as to confine the muscles of the thigh; a straight splint applied behind the limb, and quietude enjoined.

The union is generally ligamentous.

Fracture of the Thigh.

At what part of the *Neck* do fractures occur? Both within and external to the capsular ligament; but fracture within is more

common, although rare in persons under fifty years of age, and is mostly met with in old women; the bone undergoes changes in advaneed life, whieh render it more liable to this accident. There is a defieieney of earthy matter, and sponginess of the eaneelli; the neck beeomes atrophied, shortened, and sunk from the oblique to the horizontal position.

Fig. 15.

The *prognosis* is very unfavorable; union takes plaee slowly, if at all.

What are the *symptoms* of the fraeture of the neck? The limb is generally shortened; its length ean be restored without difficulty, and reaseends as soon as the extension is removed. Upon rotating the thigh, and placing the hand on the trochanter, it will turn, as it were, upon a pivot; whereas, in the sound bone it describes the arch of a eirele, the radius of whieh is formed by the neek, and crepitus may be produced.

What is the proper *treatment?* In very old subjects, plaee the patient in bed, keep the limb quiet, by a splint if necessary, for a few weeks, when the patient may be allowed to use crutehes. If the patient be young, it may unite by bone, and he should, therefore, be plaeed in a proper apparatus for keeping it in plaee.

The *Trochanter Major* may be fractured, and is known by its being drawn upward, and by crepitus. When this occurs, the displacing muscles should be relaxed, and the recumbent position assumed.

The *shaft* may be separated from the *epiphysis* in young subjects, and should be treated by extension, counter-extension, and fixing the limb by splints.

Fig. 16.

What part of the thigh is most liable to fracture? The middle in young subjects.

What are the *symptoms* of fracture of the *Shaft?* There are the general symptoms of fracture with shortening of the limb, unless it is transverse, in which case the ends are supported against each other.

What are the indications of *treatment?* The principal indications are to keep up extension, counter-extension, and coaptation, for which there is a great variety of apparatus in use.

Desault's apparatus has been very popular, and consists of an outer splint, three or four inches wide, reaching from the crest of the ilium to four inches beyond the foot, each extremity having a hole in it; an inner splint reaching from the perineum to the sole of the foot, and an upper splint reaching to the knee. A counter-extending band is passed over the perineum and through the upper hole in the splint. Extension is produced by a band or handkerchief applied to the ankle, and made fast to the lower end of the splint through the hole.

Dr. Physick modified Desault's apparatus by extending the outer splint to the axilla, in which extension is made in a line more nearly parallel with the axis of the body. A block is also placed on the inner side of the same splint, below the foot, so as to prevent obliquity in the line of extension. Bags of bran or oat chaff

Fig. 17.

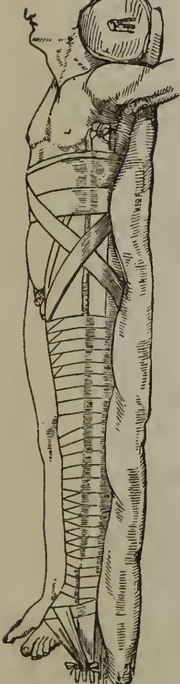


Fig. 18.

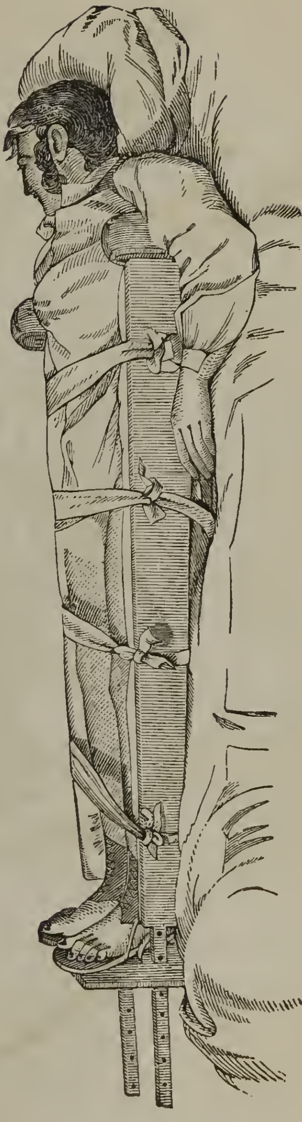
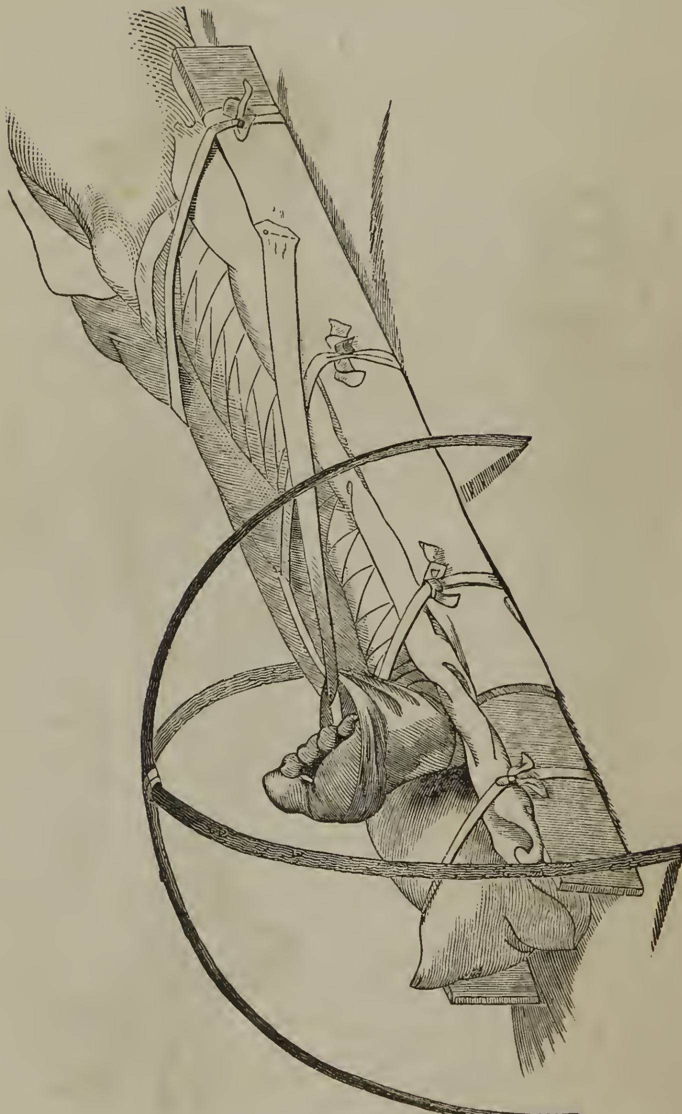


Fig. 19.



are placed on each side of the limb, so as to prevent excoriation. and keep up steady pressure; the whole is then to be secured bandages.

Liston's apparatus consists in using the outer splint alone, as seen in the figure applied. (Fig. 17, p. 449.)

Dr. Gibson recommends Hagedorn's apparatus as modified by himself, as seen in the annexed figure. (Fig. 18, p. 449.)

Physick's modification of Desault's is more popular than any other apparatus.

Fracture of the Leg.

What are the most common *varieties?* Oblique and transverse fractures of the middle, but it is liable to every variety, and in any part. Sometimes one bone is broken, and at others both. A variety of apparatus is used in their treatment. The chief purpose of a splint being to enable a surgeon to keep, effectually, the fractured surfaces of a bone in the closest apposition during the time requisite for reunion, that one, of course, should be adopted, that will best answer this purpose; and it will be found that, in some

Fig. 20.

Fig. 21.

case, sone kind will answer best, and in others another kind; depending upon the kind of fracture, the tact of the surgeon in its application and adjustment, &c.

The fracture-box and pillow has high authority to recommend it. It should have a foot-board to which the foot can be secured by bandage so as to prevent lateral inclination.

Two splints, the length of the leg, applied on either side, also answer the purpose well; care being taken to support the foot by a bandage or handkerchief, as seen in the figure. (Fig. 19, p. 450.)

Fig. 22.

The *fibula* is often fractured near the ankle-joint, and often accompanied with dislocation of the foot. The foot is turned outwards, as seen in Figs. 20 and 21, p. 451.

Dupuytren's or Physick's apparatus is preferable to any other, and consists of a single splint, placed on the inner side of the leg, and reaching beyond the foot. A wedge-shaped pad reaching only to the ankle, with the larger end applied to the internal malleolus, should be used; and a bandage applied so as to produce inversion of the foot, and retention in that position.

The *internal malleolus* is also sometimes fractured, including more or less of the tibia. (Fig. 22.) It is easily detected, and requires the same apparatus and treatment as fracture of the fibula, only the application should be on the opposite side of the limb.

Compound Fracture.

A *compound* fracture is where an external wound communicates with the fracture, and may be produced by the means causing the broken bone, by the protrusion of the bone itself, or by ulceration, subsequently. The *dangers* result from shock, hemorrhage, tetanus, suppuratiou, hectic, or typhoid fever.

If the bone is much comminuted, or a large joint opened; if large arteries are torn; if the soft parts are extensively injured; and particularly, if conjoined with age, or disease, amputation may be necessary.

When an attempt is made to save the limb, we should endeavor to convert the compound into a simple fracture, by arresting hemorrhage, clearing out the wound, and bringing the parts together properly, so that adhesion may take place.

The general principles of treatment applicable for inflammation and its results in different stages, must be resorted to, and yet secondary amputation may be necessary.

Luxations.

What is a *luxation* or *dislocation?* It is the removal of the head of a bone from its corresponding articulating cavity.

How are the *varieties* of dislocation designated? By the terms *simple* and *compound; primitive* and *consecutive; recent* and *old; complete* and *incomplete.*

Simple luxation is where there is a mere removal of the head of the bone; *compound*, when an external wound communicates with the cavity of the joint; *primitive*, when the head of the bone continues in the unnatural position it first assumed; *consecutive*, when it is removed and becomes fixed in another; *recent* and *old*, relate to the duration; *complete* and *incomplete*, denote total, and partial displacement.

How may luxations be *distinguished* from fractures? By want of crepitation, by the peculiar distortion and rigidity of the limb, and the shape of the joint.

What are the *means* generally employed? *Constitutional* and *local* means are both often necessary. Among the former are *blood-letting, warm-bath, nauseating emetics*, &c, The latter are *extension* and *counter-extension.*

A partial removal of the head of the bone from its articulating surface is termed *sub-luxation.*

If a dislocation is connected with a wound in the integuments, fracture, or laceration of large vessels, it is called *compound dislocation*, and the same general principles govern as in compound fracture.

Dislocation of the Lower Jaw.

In how many ways may the *Lower Jaw* be luxated, and what are the symptoms? Only in one — *anteriorly.* The condyles are

Fig. 23.

displaced, the mouth is thrown open and cannot be shut, and the coronoid process projects under the cheek bone. (Fig. 24.)

What is the *treatment?* The surgeon places his thumbs deep in the mouth, and rests them upon the posterior molar teeth, while the fingers are carried beneath the chin and base of the jaw.

Fig. 24.

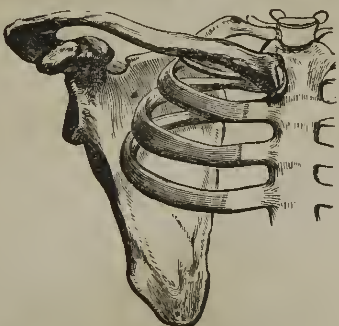
Pressure should be made downwards by the thumbs, and the chin elevated at the same moment; by which reduction may be effected.

When it depends upon relaxation of the ligaments, Sir Astley Cooper recommends blisters before the ear, shower-bath, and the internal use of ammonia and steel.

Dislocation of the Clavicle.

How many ways may the *Clavicle* be luxated? It may be luxated at either end; and the sternal portion in three directions — *forwards, backwards*, and *upwards.* They are all easily distinguished by their peculiar deformity.

Fig. 25.



What is the *treatment?* The same as for fracture of the same bone.

Dislocation of the Arm.

How many ways may the *Arm* be luxated? *Downwards, forwards, backwards*, and a consecutive dislocation *upwards.*

How should the *reduction* be accomplished? The patient should be seated in a chair; a strong band, eight or ten inches wide, passed around the chest with its middle close to the injured part, and its two ends given to an assistant on the opposite side; another cloth should encircle the arm above the elbow, be fixed and entrusted to another assistant; the surgeon should lay hold of the extremity so as to bend the elbow and rotate the humerus, while the assistants make extension and counter-extension. When

sufficient force is applied, the humerus will generally pass into the glenoid cavity with a kind of snap.

Fig. 26.

Fig. 27.

Another mode is to place the patient on his back, plaee a ball in the axilla, and then let the surgeon place his heel on the ball, seize the wrist, and by a steady foree effect the reduction. If necessary, a wet roller may be passed round the arm above the elbow, and an extending band applied, upon whieh greater tractive force ean be exerted.

Sometimes it is necessary to apply pulleys, as shown in Fig. 27, particularly in old cases.

A dislocation of this joint should not be attempted after having existed twelve weeks.

Dislocation of the Forearm.

How may the *Forearm* be luxated? *Backwards*, *laterally*, and *forwards* by a previous fracture of the olecranon.

The ulna may be dislocated *backwards*, the radius *forward* and also *backward*.

Fig. 28.

What are the *symptoms?* When both bones are thrown baekwards, there is a projeetion posteriorly; on eaeh side of the olecranon there is a hollow; the lower extremity of the humerus can be felt at the forepart of the joint; the hand and forearm are fixed in the supine position, while the joint is nearly immovable.

The *treatment* is to seat the patient; the surgeon should place his knee in the bend of the arm, take hold of the wrist, and make extension; this will have a tendeney to separate the radius and ulna from the humerus, and bring them forwards into their proper position. The forearm should then be placed in a sling after reduetion.

When the *ulna* is disloeated *backwards*, there is a eontortion of

Fig. 29.

the hand and forearm inwards, and the olecranon process projects behind the humerus. The forearm cannot be extended, neither can it be flexed beyond a right angle; these are the distinguishing marks; it is easily reduced by extension and counter-extension.

In dislocation of the *radius forwards*, the head occupies the hollow above the external condyle of the humerus. (Fig. 30.)

Fig. 30.

Fig. 31.

The forearm is slightly bent, but cannot be flexed to a right angle, nor extended completely; the hand is pronated; the head of the radius may be felt inside the external condyle, rotating, if the hand be rotated; and there is a sudden check if the elbow be flexed.

In *reducing* it, extend the wrist and supinate the hand; at the same time, press with the thumb on the head of the radius.

Dislocation of the *radius backwards* is known by feeling the head of the bone back of the external condyle; and there is partial loss of movement in the joint. (Fig. 31.)

Reduction and *treatment* same as in previous injury.

Fig. 32.

The *radius* ana *uına* may be dislocated at the wrist, both *backwards* and *forwards*. (Fig. 32.)

Reduction is effected by extension, counter-extension, and pressure; the wrist and forearm should then be placed in splints and sling.

The *radius* at the wrist may be dislocated *anteriorly*, *posteriorly*, and *laterally*.

The *ulna* may be dislocated at the wrist, and may easily be known by the change of position of the styloid process, projection of the ulna, and twisting of the hand. It may be *reduced* by extension and pressure; it should then be confined by compresses, splints, and bandages, on account of the great liability to displacement from rupture of the ligaments.

The *thumb* may be dislocated *backwards*, and also in the *opposite* direction.

Fig. 33.

Fig. 34.

In reducing it, a clove-hitch should be placed upon the first phalanx, and extension made, with some forcible and steady flexion, towards the palm of the hand; and pressure made by the thumb upon the head of the bone, which will usually succeed.

Fig. 35.

Dislocation of the Thigh.

What are the different luxations of the *Thigh?* *Upwards* and *outwards* on the dorsum of the ilium; *downwards* and *inwards* into the foramen ovale (Figs. 36 and 37); *upwards* and *forwards* on the pubes; *backwards* into the ischiatic notch, and *downwards* under the tuberosity of the ischium. (Figs. 38 and 39.)

The *first* may be known by a prominence near the superior spinous process of the ilium, formed by the great trochanter, together with a shortening of the limb, and an inclination of the foot inwards.

Fig. 36.

Fig. 37.

Fig. 38

Fig. 39.

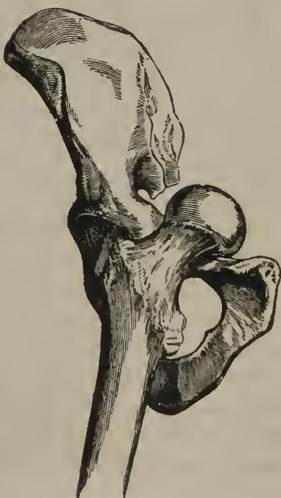


Fig. 40.

Fig. 41.

The *second* by the limb being lengthened two or three inches; the foot is turned outwards, and the head of the bone in thin subjects may be felt in the foramen ovale. (Fig. 41.)

The *third* by a hard tumor above Poupart's ligament; the limb is shortened about an inch, the foot is turned outwards, and the trochanter major is in front of the anterior superior spinous process of the ilium. (Fig. 42.)

The *fourth* by the limb being shortened half an inch, and the foot slightly inclined inwards. (Fig. 43.)

What is the *treatment?* Extension by pulleys, and counter-extension by a band passing over the perineum and resting against the tuber of the ischium.

Bleeding, warm bath, and tartar emetic, so as to produce relaxation, frequently have to be resorted to. The mode of acting and arranging the means of effecting reduction in the different forms, is well exhibited by Figs. 44, p. 463, 45, 46, p. 464, and 47, p. 465.

Fig. 42.

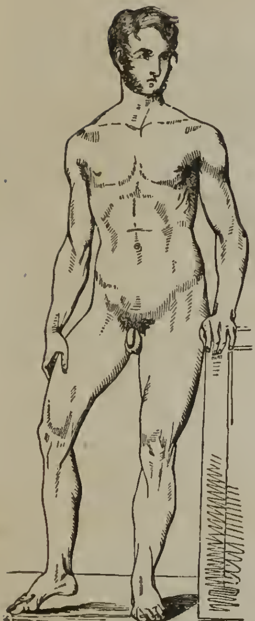


Fig. 43

Fig. 44.

Fig. 45.

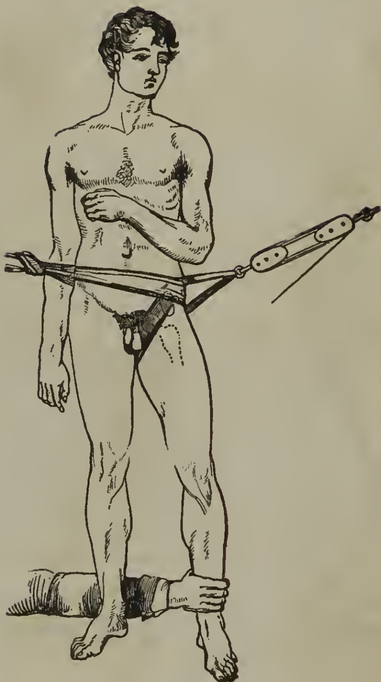


Fig. 46.

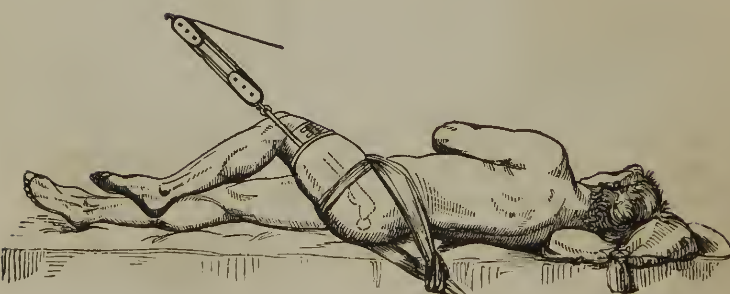
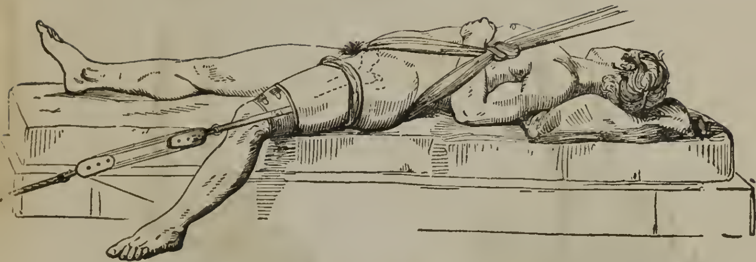


Fig. 47.



Dislocation of the Knee.

In what ways may the *Knee* be luxated? In four directions. *backwards, forwards, inwards,* and *outwards.* (Figs. 48, 49 50, and 51.)

Fig. 48.

Fig. 49.

The *diagnosis* is easily made in these cases.

Reduction is accomplished by extension and direct pressure. Inflammation is apt to be severe, and must be combated by active means, and rest enjoined for several weeks.

How may the *Patella* be luxated? *Outwards, inwards,* and *upwards* when the ligament of the patella is ruptured.

Fig. 50.

Fig. 51.

Dislocation of the Ankle.

In what direction may the *Ankle* be luxated? *Inwards, outwards, forwards,* and *backwards;* all of which may be easily recognised.

Reduction is accomplished by extension of the foot and flexion of the leg, so as to relax the gastrocnemius muscle. It is a very serious injury, and amputation will often be necessary.

The *Astragalus* is sometimes dislocated, and may be either forward or backward.

Reduction is difficult, and cannot always be accomplished, in which case excision or amputation may be necessary.

Diseases of the Bones and Joints.

To what diseases are the Bones liable? *Caries; necrosis; exostosis; spina ventosa; osteo-sarcoma; mollities* and *fragilitas ossium;* and *rachitis.*

Caries.

What is *caries?* It is an ulceration of bone.

The soft or spongy bones are the most liable to caries.

What are the *symptoms?* The affected part swells, there is a softening of the bone, and it crumbles away; there is also a discharge of fetid blackish matter, and a luxuriant growth of pale fungous granulations.

What is the *treatment?* When it is dependent upon a syphilitic, scrofulous, scorbutic, or any constitutional disorder, general remedies should be resorted to. When it proceeds from local injury, the indications are to combat inflammation, keep the parts at rest, and remove diseased portions of bone as they become loose. Mineral acids, and gastric juice have also been applied with benefit. Blisters, issues, setons, and steady purging are serviceable in constitutional caries. Fresh air, tonics, and alteratives are proper in advanced stages.

Caries of the Spine.

What are the *symptoms?* The patient complains of numbness or an uneasy sensation in the lower extremities, is languid, easily tired, and apt to trip or stumble in walking.

There is often flatulence, sick stomach, and derangement of the digestive organs. Paralysis of the lower extremities occurs in the advanced stages of the disease. There is more or less protuberance at some portion of the spinal column; the spinous processes of which project, and create considerable deformity. The most common seat is the dorsal vertebræ.

What is the *treatment?* In the commencement benefit may be derived from leeches, blisters, and caustic issues; the latter of which it is often necessary to continue for a long time. The condition of the bowels, and diet of the patient should be strictly attended to, the recumbent posture enjoined, and at the same time the benefit of fresh air should be given.

Necrosis.

What is *necrosis?* It is where there is destruction of the vitality of bone, and differs from caries as sphacelus differs from ulceration. The term *sequestra* is given to dead portions of bone thrown off. *Cloacæ* is a name for openings in the case of new bone which is thrown out. The pain is deep seated, long continued, and severe.

What is the *treatment?* It is to remove the dead pieces of bone when formed. Constitutional remedies are often required.

Exostosis.

What is *exostosis?* It is an enlargement of the bony structure, and is divided into laminated, circumscribed, tuberculated, and spinous exostosis. The bones generally affected are those of the cranium, lower jaw, sternum, ribs, and extremities.

What is the *treatment?* When it becomes troublesome, its removal should be attempted by general remedies, and low diet. If these fail, it should be extirpated, if necessary for the comfort or safety of the patient.

Spina Ventosa.

What are the *symptoms* of spina ventosa? It is a tumor involving the whole circumference of a bone, consisting of an osseous shell perforated with numerous holes, containing sometimes a thin sanies mixed with portions of lymph or a cheesy substance.

What is the *treatment?* A cure may sometimes be produced by long-continued pressure; another mode of treatment is to make an opening into the cavity, and throw in stimulating injections, or by cutting instruments excite such a degree of irritation as to cause it to fill up with granulations. If this fail, amputation must be resorted to.

Osteo-Sarcoma.

What is osteo-sarcoma? It is a malignant disease of the bones. The tumor forming the diseased part is composed of thin bony plates, arranged so as to form cells, which contain a cheese-like or fleshy matter, or a thin gelatinous fluid.

What is the *treatment?* In the early stages, constitutional remedies may avail something; of which the compound decoction of sarsaparilla with corrosive sublimate is perhaps the most efficient. Leeches and blisters have also been applied locally. Amputation, when practicable, is the only remedy likely to be permanently beneficial; even this often fails, and the disease returns, and attacks some of the internal organs, or another part of the osseous system.

Mollities Ossium.

What are the *symptoms?* The bone loses its natural firmness;

both the animal and saline parts diminish until mere shells are left, which are very soft. It is a very rare disease.

What is the *treatment?* Treatment is of little use; and all that can be accomplished is to support the patient's strength by tonics, and nutritious diet.

Rachitis, or Rickets.

What are the *symptoms?* Disorder of the digestive organs, swelling of the abdomen, emaciation, dryness or discoloration of the skin, and blackness of the teeth. These symptoms are followed by distortion of different parts of the body, which in bad cases become very much deformed.

What is the *treatment?* To strengthen the system by tonics, and keep the stomach and bowels in proper condition. Good nutritious diet, consisting of animal food, has been recommended, also frictions, and frequent bathing in salt water.

Coxalgia, or Hip Disease.

What are the terms used to denote this disease? *Morbus coxarius, ischias, spontaneous luxation of the os femoris, scrofulous caries of the hip,* and *abscess* of the *hip-joint.*

What are the *symptoms?* The first symptom is a slight pain in the knee, and emaciation of the limb; then pain is felt about the trochanter and groin, which varies in different cases, and is increased by pressure upon the hip-joint. In some cases, anchylosis is established apparently without the formation of pus; while in others there is a large abscess formed, which discharges itself by one or more openings. — During this process, the patient is sometimes worn out by hectic, and dies; at other times, anchylosis takes place; the openings heal up, and a cure is accomplished with considerable deformity.

What is the *treatment?* The habit of bending the thigh on the pelvis, and the leg on the thigh, should be corrected by curved splints gradually changed for straighter ones. — Before the abscess forms, blisters, cupping, and issues should be used, conjoined with steady purging, vegetable diet, and perfect rest.

During the suppurative stage, the strength of the patient should be supported, and such other constitutional remedies employed as are indicated.

Fungus Articuli, or White Swelling.

What is comprehended under these terms? *Inflammation* of the *synovial membrane.*

Morbid change of *structure* in the *synovial membrane.*

Ulceration of the *cartilages* of *joints.*

Scrofulous disease of the *joints, having* its *origin* in the *cancellous structure* of the bones.

What is the *treatment* of the *first* variety? In the acute form bloodletting, purgatives, low diet, &c. The affected part should be kept in a state of quietude, and elevated.—As internal remedies, mercury and sarsaparilla are often indicated.

What is the *treatment* for the *second* variety? Amputation is generally the only remedy, and this does not always succeed.

What is the *treatment* for the *third* variety? Caustic issues, blisters, setons, and absolute rest: anchylosis generally takes place, and may be considered as the safeguard of the patient.

What is the *treatment* for the *fourth* variety? The remedies for scrofula should be resorted to; also rest and adhesive strips. In all these varieties, when matter is formed in the joint, it should not be let out, but an effort made to produce absorption.

Hydrarthus, or Dropsy of a Joint.

What is the *treatment?* Blisters and well-regulated pressure will generally be appropriate treatment.

Movable Cartilage.

What is the *treatment?* If a laced knee-cap, bandages, &c., have been tried without relief, recourse may be had to an operation for its removal.

Anchylosis.

How is it *divided?* Into *complete* and *incomplete.*

In the incomplete variety, the ligaments, tendons, and surrounding cellular membrane are involved, and there is partial movement of the joint.

In the complete form, the extremities of the bones often become perfectly united and identified.

What is the *treatment?* Friction with stimulating articles, and judicious movement of the joint, in the incomplete variety.

Diseases of the Arteries.

To what diseases are arteries subject? To inflammation, suppuration, ulceration, sphacelus, calcareous concretions, uniform dilatation of the coats, and aneurism.

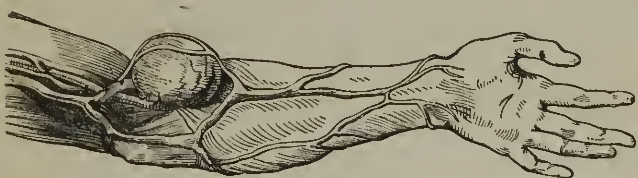
Aneurism.

What is aneurism? It has been defined to be a pulsating tumor formed of arterial blood.

What are the varieties of aneurism? *True*, *false*, *circumscribed*, *dissecting*, *diffused varicose aneurism*, and *aneurism by anastomosis*.

By *true* aneurism is understood a simple dilatation of all the coats of an artery, or the internal and middle ruptured, while the cellular coat remains entire; by *false* aneurism, a rupture or wound of the three coats, so that the blood is extravasated among the surrounding parts; the sac is formed by cellular tissue, or a new deposit of lymph, as seen in the figure.

Fig. 52.



The term *circumscribed* and *diffused* relate to the form of swelling, or extent of extravasation. In *dissecting* aneurism the sac is formed by the infiltration of blood between the coats of the arteries.

What are the *symptoms* of aneurism? The tumor is first small, free from pain, and disappears easily by pressure, but returns when the pressure is removed. As it enlarges the pulsation is lessened, and when much enlarged the integuments covering it become painful, livid, crack, ulcerate; and hemorrhage, if not arrested, sooner or later destroys the patient.

What is the *treatment?* Some benefit may accrue by frequent

and repeated bleeding; rigid abstinence; confinement to a horizontal position; the internal use of digitalis, astringents, and refrigerants; these remedies cannot be depended on, but should be pursued when the ligature from any cause is impracticable. The ligature may be considered as the only means upon which reliance can be placed, and even this often fails, and secondary hemorrhage is the consequence. Compression has sometimes succeeded.

What are the rules for the application of the ligature in aneurism? The surgeon should cut for a sound part of the artery above the sac; penetrate cautiously until the pulsations of the artery are discovered; pass an aneurismal needle round, armed with a ligature, detaching it as little as possible from its connections; the ligature should be firmly tied, one end cut off, and the other left hanging from the wound, which should be brought together by adhesive straps.

Aneurism by Anastomosis.

What are the *symptoms?* It is a tumor formed by a congeries of small arteries and veins, with an intermediate cellular structure; as it enlarges, it acquires a thrilling pulsatile or jarring motion.

What is the *treatment?* Compression, and excision are the means proposed for curing this disease; they may also frequently be cured by exciting inflammation in the part by vaccination, caustic, needle and twisted thread, hot wire, &c. Some surgeons preferring one mode, and some another. The frequent application of collodion has been useful in some cases by producing gradual compression.

Varicose Aneurism.

What is varicose aneurism? It is that form of disease in which a communication is established between an artery and a vein. It may be produced in any part of the body where a large artery and vein are near each other, and happen to be punctured at the same time.

Fig. 53.

What is the *treatment?* Compression and ligature are the means recommended.

Diseases of the Veins.

What are the diseases of the Veins? *Inflammation, and varicose enlargement.*

Varicose Veins.

What are the *symptoms?* The disease is almost entirely confined to the veins of the lower extremities. In the commencement, numerous small circumscribed swellings may be observed; at length the whole venous trunk and branches become enlarged, run in a serpentine course, and appear knotted. As they enlarge, the support afforded by the valves is diminished until they are entirely lost. The surrounding cellular membrane becomes inflamed, and gives rise to painful ulcerations.

What is the *treatment?* Compression with a roller or laced stocking; astringent washes; an elevated position of the limb; and obliteration of the diseased vein by an operation, of which there have been several kinds proposed and practised; viz., the ligature, the section, and the excision of the vein — all of which are attended with more or less danger.

Cirsocele and Varicocele.

What are the *symptoms?* Cirsocele is an enlargement or varicose state of the veins of the spermatic cord. Varicocele is a varicose state of the veins of the scrotum. When examined, the whole cord appears like a bundle of knotted and tortuous veins; and feel like a bunch of worms wrapped round and twisted together. The tumor subsides on assuming the horizontal position, and reappears on standing.

What is the *treatment?* A bag truss should be worn that will suspend the testicles, and give them a firm support. Cold astringent washes are also recommended. There are several operations, for the purpose of obliterating the vein, proposed and practised for this disease, upon which the profession is not yet very well settled.

Inflammation of Veins.—Phlebitis.

What form does phlebitis assume? It may be *acute* or *subacute*. There is not much danger in the *subacute* form; it generally affects varicose veins of the lower extremities. Swelling and tenderness about the veins and œdema of the limb exist.

Rest, leeching, fomentations, cold lotions, elevation of the limb, and purgatives; after which, stimulating frictions and pressure are the proper course of *treatment*.

The *acute* form is generally fatal. It may be caused by wounds, ligatures, bruises, erysipelas, &c.

There are rigors, weak rapid pulse, anxiety of countenance, depression of spirits, swelling and tenderness over the vein, tongue furred, brown, dry, or black; skin sallow, with prostration, low delirium, and bilious vomiting, and death often occurs in two or three days. Consecutive abscesses are very apt to occur in some joint, preceded by excessive pain, and followed by abscesses also in the lungs, liver, &c.

Leeches, repeated and followed by fomentations to the part; bowels opened and pain allayed, are proper to be done; and the abscesses should be opened early. General depletion may be necessary in some cases; stimulants and tonics in others, according to the condition of the patient. Mercury may be resorted to unless great depression exist.

Injuries of the Head.

Fractures of the Skull.

What are the *varieties* of fracture of the skull? There are several: *fissure*, *counter fissure*, *depressed*, *double depressed* or *camerated*, *stellated*, and *punctured* fracture.

Fissure is a simple crack or division; *counter fissure* is a separation produced at a point opposite to that where the force was applied; *depressed* fracture is when the bones are forced below their natural level; *camerated* when the sides decline towards the centre; *stellated* when it radiates from a centre resembling a star; and *punctured* when produced by a pointed instrument.

What is the *treatment?* In simple fracture, where the brain or

membranes are uninjured, little or no treatment is necessary. The rule in all cases is not to interfere unless the contents of the skull are affected, and of this the symptoms must be our guide. In cases, however, where sharp points, or ragged edges of bone exist, they may be removed by appropriate instruments, to prevent them from irritating the dura matter, or other adjacent soft parts. Inflammation should be guarded against in all cases.

Concussion of the Brain.

What are the *symptoms?* In slight cases there is vertigo, sickness of the stomach, trembling of the limbs, dimness of vision, &c. In severe cases there is insensibility, coldness of the skin, relaxation of the limbs, feeble and irregular pulse, difficulty of breathing, (not, however, generally stertorous,) and dilated pupils.

These symptoms may, after a time, subside gradually, when a determination of blood to the brain follows, of greater or less severity

What is the *treatment?* If called early, be careful that the importunities of the bystanders do not determine you to bleed before the pulse rises and reaction is established, when it may be proper. Content yourselves with administering a little cold water, or, if the depression is very great, wine in small quantities, and with caution. Generally, external stimulants, such as mustard plasters, will be sufficient to rouse the system, and are free from the injurious effects of alcohol upon the brain. If inflammatory symptoms come on, bloodletting, purgatives, low diet, &c., with cold to the head, an elevated position of it, and blisters, become highly necessary.

Compression of the Brain.

What are the *causes* and *symptoms?* It may arise from depressed fracture, effused or extravasated blood, and from suppuration within the brain, or its membranes.

When symptoms of compression come on from extravasation, there is generally an interval between the injury and the appearance of the symptoms; and when this occurs, may be considered as characteristic of compression from extravasated blood. When these symptoms are caused by matter, it is the result of inflammation, and does not follow immediately an injury of the skull.

If compression arise from either of the preceding causes, it may be known by the pulse becoming slow and regular; the pupils dilated, and insensible to the strongest light; breathing stertorous, slow, and difficult; the limbs loose, or yielding, perhaps paralytic; sometimes flexion of one or both forearms, and insensibility. These symptoms will be sufficient to distinguish it from concussion, where the distinction is well marked; but often the symptoms are intermixed so as to create confusion and doubt in the mind of the surgeon.

What is the *treatment?* Blood-letting, purgatives, &c. will often, alone, relieve symptoms of compression.

When the bones are depressed, they should be elevated; or, if produced by extravasation, the trephine must be resorted to, and the coagulum removed.

What are the *instruments* required for operations on the skull? Two or three trephines, the largest about an inch in diameter, and the smallest half an inch; a Hey's saw; a lenticular; raspatory; trepan forceps; two elevators, a small brush, tooth-pick, or probe; tenacula; sponges; crooked needles; ligatures, and a scalpel.

What are the objects to be attained in the application of the trephine? To make an opening for the removal of coagulated blood, and for the introduction of the elevator beneath a depressed bone. For the former a large trephine should be used, and for the latter a small one. It is not, however, always necessary to use the trephine in depressed bone, as there is often sufficient space to pass the elevator between the fragments and restore them to their proper position.

To what parts of the skull may the trephine be applied? To all parts, except to the occipital bone.

When it is necessary to trephine the inner table of the frontal sinus, two trephines should be employed; a large one for the external portion, and a small one for the inner.

Inflammation of the Brain.

What are the *symptoms?* The face becomes flushed, the eyes red, and tender to light, pupils contracted, skin hot, pulse hard and quick, and the tongue dry. The pain in the head is also severe, and the wound, if there be one, discharges a sanious matter. Rigors follow, which are dangerous symptoms. Delirium, hemi-

plegia, and convulsions may also come on in the latter stages of the disease.

What is the *treatment?* The most active antiphlogistic course should be pursued ; blood-letting, generally, and locally, purgatives, blisters, &c. If suppuration take place, the trephine may be used ; but the chance of the patient's recovery is very small.

Fungus Cerebri, or Encephalocele.

What are the *symptoms?* It is a tumor having the appearance of a vascular organized growth, which sprouts from the brain after extensive fractures, or the operation of the trephine; fills up the opening of the bone, and projects beyond the scalp.

What is the *treatment?* Light dressings, with moderate pressure upon the tumor.

This disease is generally fatal.

Diseases of the Eye.

Conjunctival Ophthalmia.

What are the *symptoms?* A sense of uneasiness or itching, an impatience of light, diffused redness of the conjunctiva, pain, heat and swelling of the globe of the eye; an increased secretion of tears, and a feeling as though there was a lodgment of sand in the eye. If the inflammation proceeds, there is violent pain in the eyeball and forehead, accompanied by fever and other general indisposition.

Fig. 54.

Sometimes the conjunctiva throws out a fungus beyond the margin of the cornea, and at others suppuration takes place, followed by destruction of the cornea, and evacuation of the humors of the eye.

There are several varieties of conjunctival ophthalmia; the *catarrhal*, *purulent*, *gonorrhœal*, and *scrofulous*. Some authors, however, adopt different divisions of the disease from this.

What is the *treatment?* In the early stage of simple inflammation it may be easily removed by blood-letting, general and local, purgatives, antimonials in nauseating doses, low diet, blisters, lotions of tepid water, a solution of opium, or acetate of lead, or sulphate of zinc. If it runs into the chronic stage, cold astringent washes, and stimulating ointments may become necessary.

For the *catarrhal* variety the proper remedies are moderate depletion at first, followed by highly stimulating collyria, and ointment.

The *purulent* variety should be treated upon common antiphlogistic principles, and moderately astringent washes, of which the liquor of the acetate of lead is one of the best.

The *gonorrhœal* variety may be treated upon general principles, but it is seldom cured.

The *scrofulous* variety does not generally require much antiphlogistic treatment, but rather a tonic course will be indicated. A blister on the nape of the neck kept open, and weak solutions of the nitrate of silver, sulphate of zinc, &c., applied to the eye, will be found beneficial.

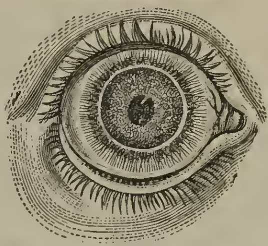
Granulations often form on the palpebral conjunctiva from long continued inflammation, which cause great pain and disturbance of the motions of the eye, and may, by continuing, render the cornea opake by friction. They can generally be cured by scarifications, lunar caustic, or sulphate of copper. In some cases they must be removed by the knife or scissors. Constitutional treatment, and blisters behind the ears are sometimes necessary.

Sclerotic Ophthalmia.

What are the *symptoms?* It is an inflammation of the sclerotic coat sometimes called rheumatic ophthalmia. The pain in the commencement is generally seated in the temple, and extends to the eye-brow and cheek of the side affected, being most severe at night. There is no purulent discharge or intolerance of light;

the sclerotic coat is of a dingy brick-dust tinge; there is more or fever and derangement of the digestive organs.

Fig. 55



What is the *treatment?* The indications are to restore the functions of the stomach, biliary organs, and skin, by emetics, purgatives, and antimonial diaphoretics, after which bark may be employed to advantage. The best local applications are a blister behind the ear, and the vinous tincture of opium as a collyrium.

Iritic Ophthalmia or Iritis

What are the *symptoms?* Severe lancinating pain, extending from the eyebrow to the orbit, and through the globe of the eye to the optic nerve; extreme impatience of light and morbid sensibility. The conjunctiva does not present the appearance of inflammation, but there are numerous red vessels on that part of the sclerotica connected with the cornea, also on the anterior part of the iris, which loses its brillancy, and changes to a reddish or greenish hue. The pupil becomes contracted, irregular, and its edge is turned backward toward the crystalline lens: lymph is deposited on the outer surface of the iris in spots, and sometimes so copiously as to obliterate the pupil.

What is the *treatment?* The antiphlogistic course should be carried to its fullest extent. Obliteration of the pupil should be prevented by breaking up any bands of coagulable lymph which may have formed, with the extracts of belladonna or stramonium, applied to the outer surface of the eyelids, or over the eyebrows, two or three times a day, and kept on for half an hour at a time. When it has a syphilitic origin, mercury, followed up with sarsaparilla, should be used. The formation of an *artificial pupil* is often necessary after this disease.

Psorophthalmia.

What is psorophthalmia? It is an inflammation or ulceration of the eyelids; whether caused by small-pox, measles, scrofula, erysi pelas, or any other cause.

What are the *symptoms?* Children of scrofulous habit are most liable to this disease. The inflammation commences on the edges of the lids, and extends along the conjunctiva, with pain and violent itching; suppuration and ulceration sometimes occur, and are very troublesome. The Meibomian glands are always involved, and pour out an adhesive fluid.

What is the *treatment?* In the early stage, purgatives and low diet, with the local application of solutions of acetate of lead, sulphate of zinc, or sulphate of copper. In the chronic stage, the unguentum hydrargyri nitrati, applied to the edges of the lids, will relieve the itching, and dispose the ulcerated surfaces to heal. If the disease resists every remedy for a long time, blisters behind the ears and a course of mercury may be tried.

Pterygium.

What is pterygium? It is a thin membranous expansion, situated on the conjunctiva; generally occupying the inner angle of the eye in the shape of a triangle, the apex of which looks towards the cornea, and sometimes extends to its centre. A pannus is a pterygium on each side, which meet in the centre of the cornea. There are two varieties, the *membranous*, and *fleshy*.

What is the *treatment?* When it becomes troublesome, it should be dissected off with a pair of curved scissors.

Encanthis.

What is encanthis? It is an enlargement of the lachrymal caruncle, and semilunar fold. It is sometimes malignant, but it is not a frequent disease. The caruncle presents a granulated and livid appearance? If the disease continue a long time, adjoining parts become involved.

What is the *treatment?* Excision of the diseased parts.

Opacity of the Cornea.

What are the *varieties* of opacity of the cornea? *Nebula, albugo*, and *leucoma.*

Nebula is a superficial opacity produced by chronic ophthalmia, and does not entirely interrupt vision.

Albugo occupies the lamella or substance of the cornea; it is of a white or pearl color, often accompanied by ophthalmia, and is always the result of an effusion of lymph.

Leucoma is a dense callous speck on the cornea, of a pure white or chalk color, and has a polished appearance. It is generally produced by a wound or ulcer.

What is the *treatment?* For the first variety astringent collyria, and such other remedies as are proper in chronic ophthalmia. The treatment of albugo is generally difficult, and requires highly stimulating applications, of which one of the best is the unguentum hydrargyri nitrati, applied by a camel's hair pencil to the surface of the speck, once or twice a day. ·Washing the eye with diluted vinegar has also been recommended.

Leucoma is perhaps seldom or never removed by any treatment.

Ulcer of the Cornea.

What are the *symptoms?* It is commonly the result of the different varieties of ophthalmia. Sometimes it occupies the whole cornea, and at others it is a simple cavity not larger than the head of a pin, on some particular part of the cornea.

What is the *treatment?* The sore should be gently touched with nitrate of silver, until an eschar forms on its surface; and when it drops off, the caustic should be renewed. When the ulcer assumes a healthy appearance, discontinue the caustic, and use mild collyria or ointments.

Staphyloma.

What is staphyloma? It is a thickening and opacity of the layers of the cornea, with a projection of its anterior surface. It may be produced by smallpox, purulent ophthalmia, wounds of the eye, &c.

What is the *treatment?* There is no remedy; except that an operation may be performed to evacuate the humors of the eye, which will prevent the pain and inflammation caused by dust and other extraneous bodies. Blindness, of course, always exists, whether the eye is operated on or not.

Hypopion.

What is hypopion, and its *symptoms?* It is a collection of purulent matter, formed within the posterior or anterior chamber of the aqueous humor.

There is redness of the conjunctive, and a yellow spot may be

seen at the bottom of the anterior chamber, which increases in size until the whole cavity is filled.

Pain, intolerance of light, &c., are very severe. In some cases, the inflammation subsides, and the pus is absorbed. In others, ulceration and sloughing of the cornea may take place, followed by a destruction of the eye.

What is the *treatment?* A prompt antiphlogistic course is the proper treatment.

Hydrophthalmia.

What is hydrophthalmia? It is a dropsy of the eye, and consists in a gradual enlargement of the globe, without, at first, much pain or injury to vision; but, as the disease advances, there is pain, impaired vision, &c., which may terminate in irritation, suppuration, and the loss of the eye.

What is the *treatment?* When it is accompanied with general dropsy, digitalis, squill, volatile tincture of guaiacum, and calomel, may be proper If the accumulation is large, paracentesis should be performed.

Obliterated Pupil.

What are the *symptoms?* The iris becomes wrinkled, and the pupil either entirely effaced or contracted to a very small compass.

What is the *treatment?* An operation dividing a portion of the iris is the only proper course.

Procidentia Iridis.

What is procidentia iridis? It is a projection of the iris through an ulcer or wound of the cornea. The pain and intolerance of light are excessive.

What is the *treatment?* When it follows a wound of the cornea, it may be replaced; but when it proceeds from an ulcer, it cannot be retained in its natural situation while the ulcer exists. The ulcer should be touched with the nitrate of silver, and healed as soon as practicable.

Cataract.

What is cataract, and the *symptoms?* It is an opacity of the *crystalline lens*, or its *capsule*, or of the *Morganian fluid*, separately, or conjointly. They differ in color and consistence. Some are fluid, and called milky; others are called gelatinous, caseous,

or hard, according to their consistence. When the capsule is opake, and the lens remains transparent, or is absorbed, it is called capsular cataract. If a cataract exist from birth, it is called congenital. Most cataracts are of a bluish, or pearl color; some are gray, or green; others white; and in some rare instances black. There are four varieties; the *lenticular*, *capsular*, *Morganian*, and the *capsulo-lenticular*.

The *symptoms* are a diminution of sight; objects appear as if enveloped in mist, or smoke; and vision is very imperfect when suddenly exposed to a strong light. In a dull light the vision is improved; and when the lens is opake, its color will generally indicate the nature of the disease. The diseases with which it is liable to be confounded are amaurosis and glaucoma.

The *catoptric* examination gives the most certain diagnostic signs of cataract. When a lighted candle is held before a healthy or amaurotic eye, three distinct images of it may be observed. *First*, an erect image, which moves upwards when the candle is moved upwards; this is caused by reflection from the surface of

Fig. 56.

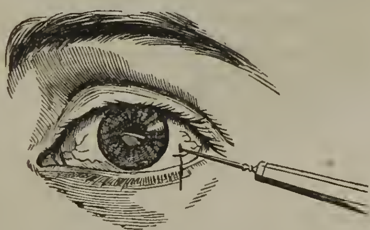
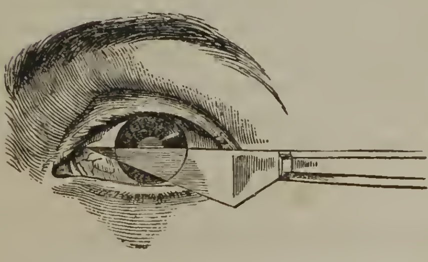


Fig. 57.



the cornea. *Second*, another erect image may be seen produced by reflection from the anterior surface of the lens, which also moves upwards when the candle is moved in that direction. *Third*, a very small inverted image is seen, that moves downwards when the candle is moved upwards, and is a reflection from the posterior surface of the lens. In cataract, this inverted image is, from the first rendered indistinct, and is soon abolished; and the deep, erect one soon disappears also.

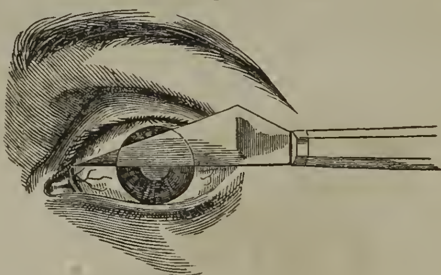
What is the *treatment?* An operation is the only treatment to be depended upon.

What are the *operations* in use for cataract? *Couching*, or *depression; extraction;* and the *absorbent* practice.

The first is done with a needle, and consists in removing the crystalline lens downwards and backwards into the vitreous humor.

Extraction is performed with a knife; and the opening is made into the cornea.

Fig. 58.



The *absorbent* practice is founded upon the solvent power of the aqueous humor; the operation is to break up the crystalline lens, and bring it in contact with the aqueous humor in the anterior chamber. It is done in two ways: one is to introduce the needle anterior, and the other posterior to the iris, so that in one case the cornea is penetrated, and in the other the sclerotica. In all instances, previous to the performance of any operation, the system should be prepared by purging, diet, &c.; and stramonium, or belladonna should be applied to the parts about the eye.

Congenital Cataract.

What is the *treatment?* An early operation.

Amaurosis.

What is amaurosis, and what are the *symptoms?* It is an insensible state of the retina.

The pupil is changed in color, greatly expanded and irregular in shape, has undulating edges, and the strongest light produces no perceptible contraction.

The pupil is occasionally contracted, and in some instances its motions are partially retained. The natural lustre of the eye becomes diminished, or lost. It is easily distinguished from cataract by the catoptric test.

What is the *treatment?* When it arises from any organic defect, the probability of affording relief is small. If it proceed from gastric derangement, emetics and purgatives will prove useful, followed by tonics. Errhines may also be found beneficial; beginning with the milder, and afterwards using the turpeth mineral combined with powdered liquorice.

Fistula Lachrymalis.

What is fistula lachrymalis? It is an overflow of tears, produced by an obstruction of the nasal duct, either in consequence of acute or chronic inflammation, which may be produced by a great variety of causes.

We should endeavor to remove the inflammation, and remove the obstruction in this way if possible, which can generally be done: if it fail, an operation will have to be resorted to. This consists in passing a narrow bistoury into the duct, introducing its point just below the tendon of the orbicularis palpebrarum; by pressing it downwards, backwards and inwards, until it enters the duct; the remaining obstruction of the duct must be overcome by passing a probe. The duct should then be kept open by a catgut or silver style, with an enlarged end, to prevent it from sinking too deep, and of sufficient length to reach from the cornea of the eye to the termination of the nasal duct. It should be removed and cleansed from time to time.

Strabismus.

What are the *causes* of strabismus? It consists either in an over-action or paralysis of some of the muscles of the eyeballs

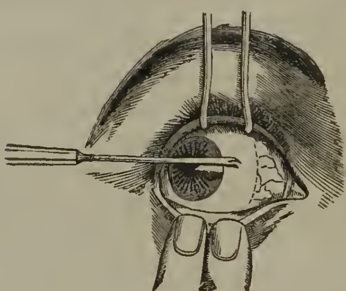
and may be *congenital* the result of imitation, or produced by *gastric*, *intestinal*, or *cerebral irritation*.

If caused by sympathetic disturbance, the *treatment* should be purgatives, alteratives, and anthelmintics. Division of the muscle will generally relieve the deformity, but not always. The operation is simple, and easily performed. The head should be supported, the eye turned outwards, the lids separated with an elevator (Pellier's answers well), or by the fingers of an assistant. Then catch the eye with a double hook, about midway between the edge

Fig. 59.

of the cornea and canthus; raise the conjunctiva at the canthus by a pair of forceps, and divide it along with the subjacent cellular tissue; pass the blunt hook under the tendon of the muscle, raise this on the hook, and divide it with the scissors.

Fig. 60.



Remove the double hook as soon as the blunt hook is passed. The division of the tendon terminates the operation. Sometimes the *inter-muscular fascia*, or some fibres of the tendon, may prevent the eye from becoming straight, in which case, pass the hook again and divide them, taking care not to divide too freely, or there may be reversion of the eye

The eye should be placed at rest, and inflammation combated if it arise. If any exuberant granulations appear, they should be touched with nitrate of silver, or clipped off with scissors.

Hordeolum.

What is hordeolum? It is a red, inflamed, painful tumor, involving one or more Meibomian glands, usually seated on the lower eyelid, near the inner angle.

What is the *treatment?* Purgatives and attention to diet. If it becomes indolent, apply lunar caustic.

Encysted tumors of the Eyelid.

What is the *treatment?* Extirpation.

Entropion.

What is entropion? It is an inversion of the tarsus or its cilia.

What is the *treatment?* When there is simply an unnatural direction of the eyelashes, they should be removed with a pair of forceps.

When the tarsus is inverted, and the skin of the eyelid relaxed, there should be an oval piece removed, and the sides of the wound brought together. Other operations are also practised.

Ectropion.

What is ectropion? It is the reverse of entropion; the eyelid being turned outwards instead of inwards.

What is the *treatment?* A portion of the lid of the shape of the letter V should be removed from the outer angle; the thickened conjunctiva should then be dissected off, and the edges of the wound brought together with a fine suture.

Ptosis.

This is a falling of the upper eyelid from a palsy of the third nerve, or from an injury of the levator palpebræ superioris muscle. It is sometimes dependent upon congestion of the brain; in which case bleeding, purgatives, mercury, and blisters are useful. Sometimes it persists, and has been treated by the removal of a fold of skin from the upper eyelid.

Diseases of the Nose and Antrum.

Polypus of the Nose.

Where are polypi of the nose generally attached? They may arise from any portion of the Schneiderian membrane; but are mostly attached to the superior, or inferior spongy bones, and are not malignant.

What is the *treatment?* They should be removed with the polypus forceps by a twisting motion rather than by pulling in a straight line. To prevent their return after removal, the application of the white precipitate ointment, softened, and applied by means of a brush, to the part from which the polypus has been removed, is highly recommended by Sir B. Brodie.

Ozœna.

What is ozœna? It is an ulceration of the lining membrane of the nostrils, having a fetid discharge, and sometimes followed by destruction of the cartilages and bones of the nose.

What is the *treatment?* Bark, iron, mineral acids, muriate of lime, sarsaparilla, and antimony have been recommended. If there is a syphilitic taint connected with it, mercury will be proper. Locally, a solution of opium and acetate of lead may be used with advantage.

Fungus, or Polypus of the Antrum.

What are the *symptoms?* It is generally a formidable affection. The tumor sprouts from the lining membrane of the antrum, and grows until it fills the whole cavity; pain is then experienced in the cheek and eye of the affected side, and the face becomes enlarged. These symptoms are followed by distortion of the nose, projection of the eye, enlargement of the gums, profuse discharges of sanious matter, &c.

What is the *treatment?* As soon as the nature of the disease is ascertained, it should be completely removed.

Diseases of the Mouth.

Labium Leporinum, or Hare-Lip.

What are the *varieties* of hare-lip? The *single* and the *double.*

What is the *treatment?* An operation. Some surgeons recom-

mend that we should operate immediately after birth, or within a few weeks, others that we should wait until the child is two or three years old, or after the period of the first dentition. It is often combined with a deficiency in the palate and maxillary bones; in which case their closure is more perfect with an early operation. The principal danger of an early operation is a liability to convulsions. The operation consists in paring the edges of the fissure in the lip, and bringing them in contact by the interrupted suture, or pins, and figure of 8 bandage.

Ranula.

What is ranula? It is an obstruction of one or more of the ducts of the sublingual glands, and gives rise to a tumor or cyst.

What is the *treatment?* Lay the cyst open freely, and remove a portion of it with scissors. Sometimes the application of caustic becomes necessary.

Malformation of the Frænum Linguæ.

What is the malformation of the frænum linguæ? It is sometimes too short, so as to prevent sucking.

What is the *treatment?* A slight division of the frænum, which should be done carefully, so as to avoid hemorrhage, and also not to allow the tongue to fall backwards into the pharynx.

Enlarged Tonsils.

What are the *symptoms?* A hoarse, husky voice, snoring during sleep, excessive wheezing when laboring under cold; and upon inspection they will be found to be enlarged.

What is the *treatment?* Removal, either with the knife or ligature.

What *instruments* are used for removing them? Fahnestock's, Physick's instrument modified by Gibson, and Chamberlin's excisor, the latter of which is to be preferred.

Elongation of the Uvula.

What are the *symptoms?* Irritation about the throat, nausea, vomiting, and hæmoptysis in some cases.

What is the *treatment?* Removal with a hook and common scissors, or other suitable instrument.

Epulis, or Tubercle of the Gums.

What are the *symptoms?* It is often a malignant form of tumor, which sprouts from the sockets of the incisor teeth of the upper jaw, or from the gum between teeth.

What is the *treatment?* Extirpation in its very incipiency is the only chance for a permanent cure.

DISEASES OF THE NECK.

What diseases are included under this head? *Lodgment of foreign bodies in the pharynx, larynx, trachea, and œsophagus; stricture of the œsophagus; ulceration of the glottis; bronchocele; wry neck, &c.*

Extraneous bodies in the Œsophagus.

In what manner may extraneous bodies in the œsophagus produce death? By producing spasmodic action of the muscles of the glottis; from distension of the œsophagus so as to press upon the trachea, and close it; or by producing inflammation or gangrene from the continued pressure; or by violent attempts in removing them.

What is the *treatment?* When the substance is large, it generally sticks in the pharynx, from which it may be removed by the finger, or a pair of forceps. Articles that can be digested, provided they have no hard, rough points, should be pushed into the stomach by a probang, unless they can be easily reached. Coins and sharp ragged bodies should be extracted by forceps, probang, hook, or some other contrivance, when practicable; but when it is not, they should be pushed into the stomach.

When it becomes necessary to push any of these articles into the stomach, purgatives and mucilaginous draughts should be taken. Dr. Physick prescribed boiled rice in large quantities, for the purpose of defending the coats of the stomach.

Stricture of the Œsophagus.

How are they *divided?* Into *spasmodic* and *permanent*, which are sometimes combined. Its most common seat is at the commencement of the œsophagus.

What are the *symptoms?* Difficulty of swallowing, pain in the stomach, nausea, troublesome eructations, and pain in the fauces.

What is the *treatment?* Bougies, with or without lunar caustic. In the spasmodic variety, camphor, opium, and ether are serviceable.

Removal of extraneous bodies from the Larynx and Trachea.

What operations are performed for this purpose? *Laryngotomy* and *tracheotomy.*

The former is the one generally adopted.

In performing this operation, should the incision be made at once into the larynx? No; the integuments should first be divided, and the hemorrhage entirely stopped; then the crico-thyroid membrane may be divided.

In what other cases are laryngotomy and tracheotomy resorted to? Sometimes from substances lodged in the œsophagus, for croup, for enlargement of the tongue and tonsils, ulceration of the glottis, &c.

Bronchocele, or Goïtre.

What is bronchocele? It is an enlargement of the whole, or a part, of the thyroid gland. Its causes are not satisfactorily understood.

What is the *treatment?* Iodine, internally and externally.

Torticollis, or Wry Neck.

What are the *causes?* Contractions of the platysma myoides, or sterno-cleido-mastoideus, cicatrices of burns, paralysis, &c.

What is the *treatment?* When it proceeds from morbid contraction of the muscles, they should be divided, and the head brought into a proper position.

HERNIA.

What is hernia? It is a protrusion of any of the contents of the abdomen, covered by peritoneum, through the parietes of the abdomen.

What are the *divisions* of hernia? Hernia is divided into *reducible, irreducible,* and *strangulated.* It may also be termed, from its contents, *enterocele, epiplocelè,* and *entero-epiplocele.*

Reducible hernia is when it is easily replaced.

Irreducible hernia, when there is permanent protrusion.

Strangulated hernia, when the parts are confined by stricture.

Enterocele, when the protusion consists of intestine.

Epiplocele, when it consists of omentum.

Entero-epiplocele, when it consists of intestine and omentum together.

There are also names given from the position they occupy.

Bubonocele, or inguinal hernia.

Oscheocele, or scrotal hernia.

Merocele, crural or femoral hernia.

Exomphalos, or umbilical hernia.

Congenital, when it exists at birth.

Ventral, when the protrusion occurs in different parts of the abdomen, without reference to natural openings.

Ventro-inguinal, when there is a combination of the two varieties.

What is the *sac* of a hernia? It is the peritoneal investment which surrounds the protruded viscera. That portion communicating directly with the abdomen is called its mouth; that portion most remote is its fundus; and the part surrounded by the aperture in the tendinous parietes, the neck.

What are the *causes* of hernia? The exciting causes are severe exercise, lifting heavy weights, playing on wind instruments, vomiting, costiveness, coughing, jumping, &c.

The *predisposing* are hereditary conformation, and preternatural laxity of the abdominal parietes.

What are the *symptoms* of reducible hernia? The tumor descends in the erect position, and retires by gentle pressure, or a recumbent posture.

If the sac contains *intestine*, its reduction is accompanied by gurgling; the tumor will also have a tense, elastic feel. *Omentum*, on the contrary, communicates a doughy sensation, and is restored to the abdomen with greater difficulty. Reducible hernia is larger after a meal, and an impulse is communicated to the finger when the patient is directed to cough.

There is generally more or less disorder of the digestive organs.

What are the *causes* of a hernia becoming irreducible? It may arise from adhesion between the sac and its contents; from membranous bands; and from extraordinary enlargements of the omen-

tum or increase in the volume of intestines. Slow inflammation is the most frequent cause of hernia being changed from the reducible to the irreducible condition.

What are the *symptoms* of strangulated hernia? In addition to the other symptoms of hernia, there is obstinate costiveness, general soreness of the abdomen, pain around the navel, sickness of the stomach, and severe pain in the tumor. These symptoms may be followed by bilious or stercoraceous vomiting, hiccup, quick, hard pulse, cold sweats, and great anxiety of countenance. If relief is not obtained, the pulse becomes thready, the patient easy, the tumor crackles when pressed upon, and assumes a leaden color; enormous distension of the abdomen takes place, the pulse becomes fluttering, and death ensues.

What is the general *treatment* of hernia? For *reducible* hernia, an appropriate truss is the proper treatment; and the patient should never be without one capable of retaining the tumor.

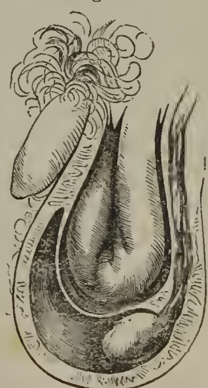
For *irreducible* hernia, a suspension of the tumor by a bag truss, and strict attention to diet, are all that can be done.

For *strangulated* hernia, the proper remedies are blood-letting, purging, cold, and warm baths, opium, fomentations, poultices, cold, the taxis, tartarized antimony, tobacco injections, and an operation.

Inguinal Hernia

Through what openings do the contents of an inguinal hernia pass? Through the internal abdominal ring, inguinal canal, and the external abdominal ring. It may be *oblique*, as when it follows the course of the spermatic cord; or *direct*, as when it does not follow the course of the cord, and is not therefore covered by the cremaster muscle, but bursts through the conjoined tendon of the internal oblique and transversalis muscles, opposite the external ring.

Fig. 61.



Suppose a dissection is made of the coverings and contents of an inguinal hernia commencing at the skin, what will we find? The integuments, superficial fascia, cremaster muscle, hernial sac, omentum, or intestine, or both.

How is the operation for inguinal hernia performed? The patient should lie on his back, knees and shoulders elevated; the surgeon standing in a convenient position, should make an incision through the skin over the neck and body of the tumor, its upper extremity being near midway between the anterior superior spinous process of the ilium and the tuberosity of the pubes, and its lower about midway of the scrotum; next, divide the cellular membrane, &c., so as to lay bare the sac, in which make a small aperture

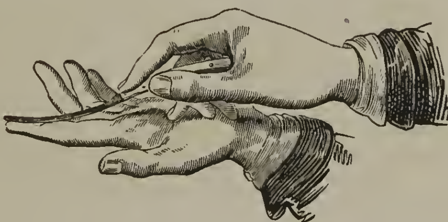
Fig. 62.

Fig. 63.

Fig. 64.

cautiously; and then lay it open freely with a probe-pointed bistoury; pass the apex of the forefinger of the left hand to the neck of the sac, and the bistoury laid flat upon it; the latter should be insinuated cautiously beneath the stricture, which must be divided

Fig. 65.



by turning the edge and pushing it upwards and forwards, so as to cut the anterior part of the sac and other structures assisting in the formation of the stricture: the knife being withdrawn, the bowel should be pushed gently upwards until it reaches the abdomen; then stitch the wound and cover with a thick broad compress, which should be retained by means of a roller.

How is inguinal hernia distinguished from *hydrocele?* The tumor of hernia commences above or at the external abdominal ring, and descends towards the scrotum; whereas, hydrocele commences below, and gradually ascends.

How is it distinguished from *cirsocele?* Place the patient in a horizontal position, press firmly on the upper part of the ring, then direct him to rise; when, if it be cirsocele, the tumor will reappear, with an increase of size; on the contrary, hernia will not show itself until the finger be removed.

What is meant by *concealed* inguinal herna? It is a hernia

contained within the canal leading from the internal to the external ring.

In operating for inguinal hernia, what parts are *divided?* The integuments, superficial fascia, cremaster muscle, and the sac.

Where is the *seat* of stricture in inguinal hernia? In very old and large ones the external ring, but in recent cases the internal ring; these strictures should be divided upwards in all cases so as to avoid wounding the epigastric artery.

Femoral Hernia

Through what opening are the contents of a fermoral hernia protruded? Beneath Poupart's ligament, through the crural ring.

How is the ring *bounded?* On the outer or iliac side by the femoral vein; on the inner or pubic side by Gimbernat's ligament; anteriorly by Poupart's ligament, and posteriorly by the pubes.

In dissecting a femoral hernia commencing at the bend of the thigh, what *parts* will be presented? The integuments, superficial fascia, fascia propria, which was originally loose cellular membrane, occupying the orifice of the crural ring, and the hernial sac

What is the *treatment?* For *reducible*, an appropriate truss.

For *strangulated*, the treatment must accord with the general principles proper in hernia.

Where are the points of stricture of femoral hernia? At Hey's ligament, in the crural sheath, at Gimbernat's ligament, or at the mouth of the sac. In dividing these strictures, the knife should be turned upwards, and slightly inwards in making the incision. If turned outward, the crural vein and epigastric artery might be injured, or, if too far inwards, the obturator artery may be endangered.

How is the operation for femoral hernia performed? The patient should bend the thigh upwards on the pelvis, lie in a horizontal position with the chest elevated. An incision should be made three inches long over the tumor, the dissection should be done cautiously, and, whatever may be the thickness of the coverings, they must be divided; when the sac is opened, the finger should be passed to the stricture with the probe-pointed bistoury advancing beyond it, and turned towards the stricture in such a manner as to make an incision sufficient to admit of the reduction of the contents of the sac.

Umbilical Hernia.

Through what opening do the contents of umbilical hernia protrude? The umbilical ring, either at its centre or edges.

What forms the outer covering of congenital umbilical hernia? The cellular membrane that connects the vessels of the cord; the inner, or sac, is a portion of peritoneum.

What forms the *covering* of the protruded viscera of young subjects and adults in umbilical hernia? The common integuments, superficial fascia, and peritoneal coat.

What is the *treatment?* The congenital variety, unless there is some considerable deficiency of parts or morbid complications, may be often cured by a bandage; or by reducing the intestines, and surrounding the sac with a firmly drawn ligature, so as to produce sloughing, and cause the edges of the ring to cicatrize.

For umbilical hernia of young subjects and adults, a properly contrived truss is the proper treatment; or a small compress, retained in its proper place by a bandage or adhesive straps.

For *strangulated* umbilical hernia, the usual remedies should be used, and, if they fail, an operation must be resorted to.

Congenital Inguinal Hernia.

In what respect does *congenital* hernia differ from common *inguinal?* It is destitute of a distinct peritoneal sac, in being lodged in the tunica vaginalis in contact with the testicle, and the spermatic cord and artery lie behind the hernia.

What is the *treatment?* A well-contrived truss, and, when strangulated, an operation may be required unless relieved by the usual remedies.

Artificial Anus.

From what does it proceed? A mortified intestine in strangulated hernia; in which case the sound portion adheres to the neck of the sac, the portion protruded sloughs, is thrown off, and the feces are discharged externally; it may also be caused by a penetrating wound, or an abscess or ulceration of the intestines.

What is the *treatment?* Nature often effects a cure; it is not best therefore to be too officious in the early stages, but simply apply a truss with a broad pad to the opening, which will retain

the feces. In this disease, the upper and lower portion of intestine lie side by side; and a very ingenious operation was suggested and practised successfully by Dr. Physick; the principle of which is, to produce adhesion between these two portions, then divide the barrier between them, and by that means establish a communication between the upper and lower portions, and suffer the external opening to close. This adhesion was produced by passing a crooked needle armed with a ligature within the orifice of one gut, and bringing it out at the other, traversing in its passage the coats of each; the ends of the ligature were then tied in a loose loop.

Diseases of the Rectum.

Prolapsus Ani.

What are the *causes* of prolapsus ani, or inversion of the lining membrane of the rectum? Habitual costiveness, straining at stool, diarrhœa, dysentery, hemorrhoids, strictures, stone, drastic purgatives, &c.

What is the *treatment?* The parts should be returned as soon as possible by gentle pressure. If there is much inflammation, blood-letting, general and local, mild cathartics, cold poultices, astringent washes, &c., should first be resorted to. Where the parts become indurated, and incapable of reduction, it may become necessary to remove them, either with the ligature or knife.

Hemorrhoids

What are hemorrhoids? They are tumors situated about the rectum, sometimes distinguished as *internal* and *external*, from their situation; *blind* and *bleeding*, according as they are attended or not with hemorrhage.

They may consist of varicose enlargements of veins, or from blood poured into cysts formed by cellular membrane, or from a more organized growth.

What is the *treatment?* To palliate urgent or present symptoms, recourse may be had to leeches, cold astringent washes, astringent ointments, rest, &c. They may, by becoming large and troublesome, or irreducible, require an operation, either by the knife or ligature. When they consist of varicose enlargements, the ligature

should always be used; on the contrary, in the other kinds, the knife may be proper.

Fistula in Ano.

What is fistula in ano? It is an abscess about the verge of the anus, with one or more small openings. If the opening communicates with the rectum, and not with the integuments, it is called *internal* fistula; if it opens upon the surface of the integuments, it is an *external* fistula; and if there is an opening both internal and external, it is called a *complete* fistula.

What is the *treatment?* Absolute rest, moderate diet, and mild laxatives.

When the disease is long established, an operation becomes necessary, unless consumption exists, in which case the fistula ought not to be healed.

"A better and easier mode of performing the operation is by passing a grooved director through the stricture, against or into the intestine; then pass into the rectum a smooth rounded stick, like a rectum bougie, the size of the thumb, the stick having a groove upon one side as wide as the finger; this being passed up and held firmly by an assistant, the surgeon takes the director and impinges it firmly against the groove in the stick; he now takes a sharp-pointed knife, and runs it forcibly down the groove of the director; the moment it comes in contact with the rectum stick, he makes a strong incision outwards against this, and thus divides the fistula at one sweep. This operation is performed in half the time that the other is, and with much less pain to the patient, and greater convenience to the surgeon. Any one who performs the operation once this way will not be likely to employ the other mode. The French surgeons, many of them, after dividing the fistula, dissect out its walls; thus cutting out a tube of the indurated soft parts." — *Hastings' Surgery.*

Diseases of the Testicle and Penis.

Hydrocele

What is hydrocele? It is a collection of water in the tunica vaginalis; and forms an elastic pyriform tumor, which at first occupies the lower part of the scrotum, and gradually extends upwards.

What is the *treatment?* An operation is generally required; and is either palliative or radical.

The palliative operation is simply the evacuation of the fluid by a lancet or small trocar.

The operation for radical cure may be performed by laying open the tunica vaginalis; by passing a seton through it; by applying caustic; by extirpating a part of the tunica vaginalis; by the introduction of a tent; and by injection, after the water has been evacuated.

The last operation is the one usually performed, and generally with success when properly done. There are several different articles made use of for the purpose of injection.

Fig. 66.

How is the operation for *tapping* in hydrocele performed? The scrotum should be seized in the left hand, raised and squeezed, so as to render the skin tense in front; the point of the trocar, held in the right hand with the forefinger close upon it, should be thrust into the front of the swelling midway between the ends. When entered, the finger must be raised; and as the trocar is withdrawn the canula should be pushed farther in, where it should be allowed

to remain until the fluid has run off. When injections are used, they may be introduced through the canula.

Hæmatocele.

What is hæmatocele? It is a collection of blood, either in the tunica vaginalis testis, within the tunica albuginea, or in the cellular membrane of the scrotum. It may proceed from injury of one or more of the bloodvessels of the scrotum.

What is the *treatment?* If the extravasation is small, it will probably be absorbed in a short time. If it is not, an incision should be made, and the blood evacuated.

Phymosis.

What is phymosis? It is where the prepuce is contracted in front, and cannot be drawn over the glans penis.

There are two varieties: the *natural*, when it exists at birth; and the *preternatural*, when it occurs at any other period of life.

What is the *treatment?* An operation; either by slitting up the prepuce, or removing a small portion by circumcision.

In preternatural, when attended with high inflammation, the best remedies are local bleeding, emollient poultices, fomentations, &c.

Paraphymosis.

What is paraphymosis? It is where the prepuce is firmly retracted behind the corona, leaving the glans penis uncovered, and sometimes producing great constriction and swelling. It may be congenital or acquired.

What is the *treatment?* Cold, the antiphlogistic course, and steady pressure, kept up for several minutes. In extreme circumstances, the stricture must be divided.

Diseases of the Urethra and Bladder.

Stricture of the Urethra.

How are they *divided?* Into permanent, spasmodic, and a combination of the two.

What part is the common seat of stricture? Usually behind the bulb, about seven inches from the extremity of the glans; also,

at the distance of four or five inches, and three and a half inches; sometimes the orifice itself is the seat of stricture.

What are the *symptoms?* The constitutional symptoms are disorder of the digestive functions, general irritability, severe chills, followed by high fever, and profuse perspiration; the febrile paroxysm is not, however, an invariable attendant.

The local symptoms are a slight discharge of matter from the urethra; a frequent desire to urinate; the urine issues in drops, or in a forked, twisted, wiry, or thread-like stream; nocturnal emissions; scalding of the urine, &c. Excess in eating, drinking, and cold, aggravate all these symptoms.

What is the *treatment?* The first object is to ascertain the position and extent of the stricture; which may be done by a bougie, catheter, or urethra sound.

There are three methods of cure. Dilatation by bougies, destruction by caustics, and division by a stilet.

Fistula in Perineo.

What is fistula in perineo? It is an abscess communicating externally, and with the urethra internally. It may proceed from strictures of the urethra, or from blows or other injuries.

What is the *treatment?* If it depend upon stricture, the first indication is to get rid of that; if the canal anterior to the fistula becomes obliterated, it can only be accomplished by an operation. When the fistula is pervious, it should be dilated with bougies, or such other means as the case may require.

Retention and Incontinence of Urine.

What are the *causes* of retention of urine? Severe gonorrhœa, strictures of the urethra, enlarged prostate, spasm of the neck of the bladder, stone, hemorrhoids, fistula in ano, stimulating diuretics, blisters, &c.

What are the *remedies* for retention of urine? The warm bath, blood-letting, purgatives, opiate enemata, the catheter, forced injections to overcome obstructions, and puncture of the bladder.

The following plan is recommended by M. Cazenave, and published in *Ranking's Abstract*, No. 10, December, 1849.

"When called to a patient laboring under complete or incomplete retention of urine, I immediately cause the large bowel to be

emptied by an oily clyster, or prescribe a purgative one, if there has been no motion, for fifteen or eighteen hours. When the first clyster has been returned, I make use of another, less in bulk, of cold water, or (what is better) bladders, filled with roughly-pounded ice, are placed around the penis upon the perineum, thighs, anus, and hypogastrium. If the patient do not pass more or less water, after half an hour of this treatment, I have him laid on the edge of the bed with a water-proof cloth under him, and then subject him for twenty or twenty-five minutes to a cold ascending douche, in a small continuous stream. At the end of this time I give another cold lavement, and continue refrigerants, and in an hour I have generally been rewarded by success."

When it is necessary to puncture the bladder, it should be done either through the perineum, above the pubes, or through the rectum; the operation of puncturing above the pubes is the one generally performed.

How are these different operations *performed?* When opened above the pubes, lay the patient on a table, shoulders and knees slightly raised; make an incision about three inches long above the symphysis, through the skin and linea alba, when the cellular tissue in front of the bladder will be exposed, and this organ may be opened with the point of a knife, or, what is better, with a trocar and canula; the canula or an elastic catheter should remain in the wound for some days. If the opening is made in the perineum, it may be done as in lithotomy.

If it is done through the rectum, a curved trocar and canula, about seven inches long, should be introduced into the rectum on the concavity of the forefinger of the right hand; the point should be placed on the triangular space behind the prostate; and then be forced through the tunics of the rectum and bladder, and the trocar withdrawn; when the urine will flow through the tube; a flexible catheter may be introduced through the canula, and allowed to remain. Great care should be taken not to introduce the instrument high enough up to wound the peritoneum, which might be fatal.

What is the *treatment* for *incontinence* of urine? The internal use of cantharides, muriated tincture of iron, bark, opium, cold bath, and blisters, either singly or conjoined, in such a manner as may be indicated.

Urinary Calculus.

Where are urinary calculi *found?* In the kidney, ureter, bladder, prostate gland, or urethra, but they are mostly found in the bladder.

What are the *symptoms* of stone in the bladder? Frequent desire to make water, and severe pain on voiding the last drops of it; sudden stoppage of the urine while passing, and flowing again frequently by change of posture; and tenesmus. Sounding is, however, the only positive symptom, and should always be done before a course of treatment is adopted.

What is the *treatment* for urinary calculus? When there is a calculus passing the ureter, decisive treatment should be adopted. Blood should be drawn freely if the patient is robust, and a brisk purge given; the warm bath and spirits of turpentine, or spirits of turpentine and opium, may be used with benefit; the tincture of the pokeberry juice has also been recommended. When the bladder contains a stone, the operation of *lithotomy*, *lithotrity*, or *lithotripsy* must be performed.

What circumstances are considered *adverse* to the success of *lithotrity?* The smallness of the diameter, and greater irritability of the urethra before puberty; or any obstruction to the free passage of instruments, as stricture, enlarged prostate, &c.; a sacculated condition of the bladder; and an unusually irritable condition of the urethra or bladder.

What circumstances are considered as *favorable* for its employment? A large and callous urethra, a capacious and apathetic bladder, with a good muscular power; a healthy prostate, and a small or moderately sized stone.

The instruments for performing this operation are various, some surgeons preferring one, and some another.

Under what circumstances should *lithotomy* be preferred? Always, (when any operation is performed,) where the circumstances exist that are adverse to the success of lithotrity; although the existence of these only give a negative advantage to lithotomy.

In what manner should the operation of lithotomy be performed? The patient should be placed in a favorable condition for the operation, the perineum should be shaved, a clyster of warm water administered an hour before, and his urine should also be retained

for that period at least. A firm table and a chair of the proper heighth should be selected, and all the apparatus should be in perfect order, and placed so as to be easily procured when wanted. The first step is to introduce the staff, which should be as large as can be done with ease; and having the groove presented a little to the left side of the urethra; the stone should then be felt with the instrument, and the latter given in charge of an assistant. The patient should next be secured; a piece of broad worsted tape, three yards long, should be doubled and formed into a loop, which should be fastened on the wrists; he should be directed to grasp the outer margin of the feet; the ends on each side should then be passed around each hand and foot, so as to secure them firmly. Two assistants, one at each knee, will be required to support them, and hold the thighs properly apart. The breech should be placed at the margin of the table. The assistant should hold the staff in the left hand nearly perpendicular, with the concavity of the curve resting on the upper part of the triangular ligament; and he should draw the scrotum slightly upwards and a little to the right side, and he should stand on the right of the patient. The surgeon should be seated in front of the perineum; the condition of the prostate should be examined, and the exact situation of the rami of the pubes, and ischium, and the tuberosity should be traced. The knife recommended by Fergusson should be used, and held much in the manner of a common bistoury. The point should be entered about one inch and three-fourths in front of the anus, about a line's breadth left of the raphe, pushed through the skin, and carried by a kind of sawing motion down to the left side of the perineum, about an inch beyond the anus; the middle of the incision being at equal distances from the latter part and the tuberosity; the blade should then be run along the surface of the exposed cellular tissue; the forefinger of the left hand should be thrust down into the wound, and placed upon the membranous portion of the urethra; if resistance is offered, the resisting parts should be divided by the knife The groove in the staff being felt by the finger, the knife should be passed along it, and made to perforate the urethra about three lines in front of the prostate, and then slid along the groove until it has entered the bladder, having slit open the side of the urethra and notched the margin of the prostate. If the stone is supposed to be large, the opening in the

bladder should be enlarged slightly on withdrawing the knife. The forefinger of the left hand should be gently introduced into the bladder along the staff, so as to dilate the parts, and, when in the bladder, to search for the stone and to retain it near the neck. The staff should then be removed by the assistant, and the forceps introduced slowly and carefully, as the finger is removed; the stone should then be seized and extracted by a slow, zigzag movement; which, being done, the operation is completed. The interior of the bladder should be examined by the finger or a proper instrument, so as to ascertain whether there are any others remaining. The patient, being loosed, should remain in bed, either on his back or right side. The after-treatment should be regulated by circum stances. The wound generally closes in about three weeks, sometimes earlier, and at other times later.—*Fergusson.*

Amputation.

What are the injuries for which Amputation is resorted to? *Gun-shot wounds and fractures*, *mortification*, *tumors*, *diseased joints*, and *ulcers*.

What circumstances influence us in regard to the propriety of amputation in *gun-shot wounds* and *fractures?* When the chief arteries of a limb are divided, the muscles lacerated, and the bones badly broken, amputation should be performed; also when complicated with severe injury of the joints.

What *tumors* may render amputation necessary? Osteosarcoma, spina ventosa, exostosis, fungus hæmatodes, &c.

What are the different *modes* of *performing* amputation? By the *circular incision*, and by what is termed the *flap operation.* Some surgeons prefer one mode, and some the other.

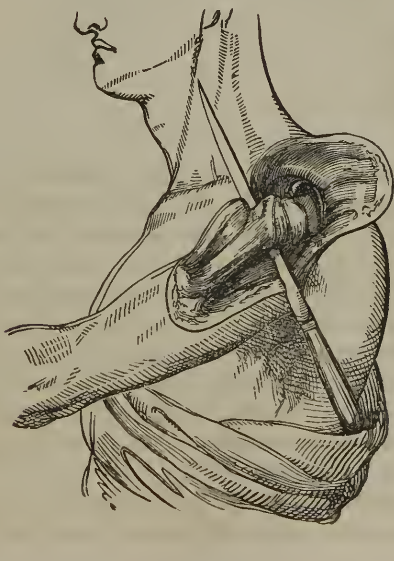
How is the *circular operation* performed? An assistant, or the left hand of the operator, should grasp the limb and retract the skin as far as possible; the knife should then be made to encircle the limb, the edge sinking through the skin; the integuments should be further retracted, and parts preventing this should be divided; the knife should be made to sweep round the limb again, close to the retracted skin, to the depth of about half an inch or more, through the aponeurosis and superficial muscular fibres: the parts should be still further retracted, and the knife again applied

so as to divide all the muscles and textures down to the bone ; a retractor should then be applied to the part so as to cover the wound, (two ends, if one bone ; and three, if two bones,) and drawn firmly upwards ; and any muscle adhering to the bone and preventing retraction should be divided close to the cloth, at which point the saw should be applied to the bone. Great care should be taken to procure sufficient soft parts to effectually cover the end of the bone. The wound should then be dressed after the arteries are secured in such a manner as to produce union by the first intention, and the line of junction may be transverse, vertical, or oblique, according to the fancy of the surgeon ; the parts should then be retained by stitches, straps, and bandages.

This description is a general one, and will apply to any of the limbs on which the circular operation may be performed.

How is amputation at the *Shoulder-joint* performed by the *flap operation?* There are several modes recommended ; some make vertical flaps, while others form horizontal ones. A good mode is to make a semilunar incision from a little behind the root of the

Fig. 67.



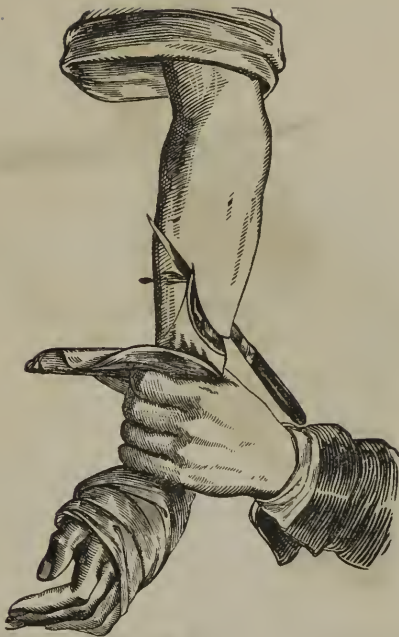
acromion towards the coracoid process, and thus make a flap from the skin and deltoid; which being raised, the joint may be opened from above; and another flap preserved from the remaining parts below the bone. The arteries should then be secured, and the wound dressed in the usual way. (Fig. 67.)

Fig. 68.

How is amputation *above the elbow* performed? The elbow should be separated from the side, and a tourniquet applied, or pressure made with the hands; the arms should be transfixed three inches above the external condyle with a suitable knife, which should be carried obliquely downwards and forwards, so as to make the inner surface of a semilunar flap two or three inches in length; divide the opposite side in the same manner; draw the two flaps upwards, pass a knife around the bone, which should next be sawn through, and the removal is finished. The arteries should be secured, and the flaps brought in contact and retained by the proper dressings. (Fig. 68.)

How at the *Elbow-joint?* A semilunar incision should be made through the soft parts on its anterior and upper part obliquely to-

Fig. 69.



wards the joint, which must be cut into ; bend the limb backwards, so as to allow the knife to be carried across to the posterior surface, where a flap must be left, which, with that in front, will cover the stump ; in forming the posterior flap, the triceps must be cut through, or else the olecranon process divided with the saw or forceps.

How is amputation of the *Forearm* performed? The elbow slightly bent, the hand pronated ; pass a blade about six inches long from one side to the other behind or above the bones ; let it be carried obliquely, so as to come out one inch and a half lower down ; raise the flap, pass the knife across close in front of the bones, and carry it obliquely downwards, when a second flap is formed ; draw these apart, divide all the textures on and between the bones, apply a retractor, and saw off the bones close to it. (Fig. 69.)

Fig. 70.

How at the *Wrist-joint?* Hold the hand in a horizontal position, back upwards; take a scalpel or a large bistoury, carry it in a semilunar course down to the bones from one side to the other, about an inch or more below the articulation; dissect up the flap, open the posterior part of the joint, bending the hand downwards at the same time; the textures on each side of the wrist should then be cut through, and a flap made similar in size and shape to the one already formed. (Fig. 70.)

At what point should amputation of the *Leg* be performed? At the *middle*, when a choice can be had.

How should it be done? Apply a tourniquet or other compression; place the patient on a firm table, supported and held by assistants, one of whom should support the part to be removed; the surgeon should pass an amputating knife, seven or eight inches long, from one side to the other, close behind the bones, cut a flap from the back part of the leg, three or four inches long; next draw

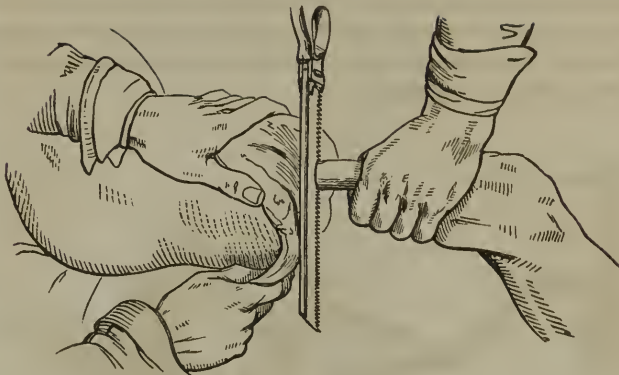
the knife across the fore part of the leg with a semicircular sweep between the points transfixed by the knife; the flaps should be drawn up by the retractor, and the remaining parts divided upon and between the bones close to it, where the saw should be applied, and the separation completed.

Fig. 71.

How should amputation of the *Thigh* be performed? The femoral artery should be controlled by a tourniquet or by compression. The surgeon, standing on the outside of the limb, should

Fig. 72.

Fig. 73.



grasp the outer side of the thigh between his fingers and thumb, draw it from the side of the bone, pass the knife from before backwards, and cut downwards and outwards so as to form a flap; next, introduce the knife in front and carry it backwards as before, but on the other side of the bone, when, by cutting again obliquely towards the surface, the inner flap is formed: use a retractor, divide the remaining portions on the bone close to it, and use the saw. Some surgeons make the flaps from the anterior and posterior portions of the thigh instead of the lateral; and this method appears to possess some advantages, particularly for the upper portion of this limb. Liston prefers the anterior and posterior flaps, as shown in the figures. (Figs. 72 and 73.)

How should amputation of the *Penis* be performed? It should be grasped in the left hand, and separated by one stroke of the bistoury or catlin. The hemorrhage may be restrained by the pressure of an assistant until the arteries can be secured.

Ligature of Arteries.

At what point, and in what manner, should the *Subclavian Artery* be secured? Above the clavicle, at a point on the outer (acromial) margin of the scalenus anticus muscle. Patient on his back, head elevated and slightly turned to the side opposite; shoulder of the side to be operated on drawn downwards and for-

wards. The incision should be made three or four inches long, half an inch above and parallel with the clavicle, extending from the clavicular portion of the sterno-mastoid to the interior margin of the trapezius; the parts next to be divided are the platysma myoides and cellular texture; the external jugular, when exposed, should be pressed to one side; and the dissection through fat and cellular substance down to the omo-hyoid should be carefully made; draw this muscle to one side with a blunt hook; dissect again carefully with a blunt implement, dividing carefully any muscles in the way, sufficiently to give room; by then passing the finger down, the artery may be perceived pulsating; it should then be more exposed, and the aneurism needle passed under it from before backwards, and the ligature can then be made to encircle the artery; the identity of the artery should be proved before making the ligature tight, by compressing it, and noticing the effect on the pulse. Leave the ends of the ligature out, (after tightening it,) and dress the wound properly.

In what manner should the *Arteria Innominata* be secured? Make an incision four inches in length, commencing over the middle of the upper part of the sternum one inch below its margin, and passing upwards parallel with the inner border of the sterno-mastoid. The skin, fibres of the platysma myoid, superficial fascia, a portion of the sterno-mastoid, cellular substance, the sterno-hyoid and sterno-thyroid should all be carefully divided; the vessel should then be looked for in the cellular membrane, opposite the upper margin of the sternum, and when found, the ligature may be passed round it.

In what manner should the *Common Carotid* be secured? The upper third should be selected when practicable; the patient on his back, shoulder slightly elevated, head turned to the opposite side; commence the incision one inch and a half below the pomum Adami, over the inner margin of the sterno-mastoid, and carry it upwards three inches or more, parallel with its fibres. The skin, platysma myoides, and superficial fascia should all be divided to this extent; the fibres of the sterno-mastoid should be drawn slightly outwards, and the cellular tissue forming the sheath to the vessels cautiously opened with the knife, opposite the middle of the thyroid cartilage; the artery can then be seen and felt; carefully dissect the outer margin of the artery from its attachments,

and then pass the needle round it, *keeping the point close upon the vessel,* from without inwards, and the operation may be finished as in other cases.

In what manner should the *External Carotid* be secured? Place the patient as above; make a lunated incision, convexity backwards, between the mastoid process and the body of the hyoid bone; the skin, platysma myoides, and superficial fascia, should all be divided to the same extent, and the lower part of the parotid gland brought into view, which should be turned slightly upwards, and the external carotid may be exposed by separating the digastric and stylo-hyoid muscles; a ligature can then be thrown around it, carefully avoiding to include other parts.

In what manner should the *Humeral Artery* be secured? The lower third of the arm should be selected if possible. Make an incision three inches long through the skin and intervening textures, along the inner margin of the biceps; carefully separate the nerves and veins that lie along with it, and pass a needle around the artery without including any of them.

In what manner should the *Radial Artery* be secured? The most favorable point is three inches above the wrist, where its pulsations can be distinctly felt. The forearm should be placed in a supine position, on a firm table; make an incision two inches in length, about half an inch on the radial margin of the tendon of the flexor carpi radialis; the skin, aponeurosis, and a little cellular substance being divided, the artery can be readily detected and secured. Higher up, this artery may be exposed between the supinator longus and the pronator teres.

The *Ulnar Artery* may be secured most conveniently above the wrist about two inches; in which place it is accompanied by two veins and a nerve; its situation is between the flexor carpi ulnaris and the flexor sublimis, and may be exposed by dividing the skin, fascia, and cellular substance between them.

In what manner should the *External Iliac Artery* be secured? Patient on a table, shoulders and knee slightly elevated; make an incision three and a half inches long, about an inch above and parallel with Poupart's ligament, one end being opposite the anterior superior spinous process, the other a little above the opening in the tendon of the external oblique; the skin, fascia, and superficial epigastric vessels being divided, the tendon just

named should then be cut to a similar extent; — now the lower margins of the internal oblique and transversalis muscles must be looked for, and the point of the finger or the director passed beneath them; they should be divided about half an inch upwards, when the fascia transversalis will be exposed almost exactly over the internal abdominal ring; make here a slight scratch or opening large enough to permit a view of the iliac fascia where it covers the psoas muscle, when the artery will be discovered on the soft brim of the pelvis, covered with a thin layer of cellular substance, forming a kind of sheath for it and the vein, which lies close upon the artery; make a slight opening into the sheath, and insinuate the point of a needle from within outwards, so as to avoid the vein, and the operation should then be completed in the usual way.

In what manner should the *Femoral Artery* be secured? It may be done in the middle or higher up; the patient should lie on his back, with the leg bent at the knee, and the thigh slightly rotated outwards, and bent upon the pelvis. Make an incision in the middle of the thigh three or four inches in length, parallel with the vessel and with the sartorius muscle. The skin, subcutaneous cellular textures, and aponeurosis being divided, the sartorius may be seen, which may be turned either outwards or inwards, and at the bottom of the space between the vastus internus and the adductor longus the vessel may be discovered in close contact with the vein and saphena nerve; pass the needle on either side of the vessel which may be most convenient, but in close contact, so as to prevent wounding the vein.

In what manner should the *Posterior Tibial Artery* be secured? If the situation of the ligature can be selected, it should be where the vessel lies between the malleolus and calcaneum. Make an incision two inches long midway between this process and the insertion of the tendo-Achilis, dividing the skin and aponeurotic fibres, which will expose the artery in company with two veins, which may be separated and the vessels secured. If we should wish to secure it four inches above the ankle, it may be done by making a free incision about half an inch posterior to the margin of the tibia dividing the skin, cellular substance, and fascia; the artery may then be found on the flexor communis and tibialis posticus muscles, with a vein on each side.

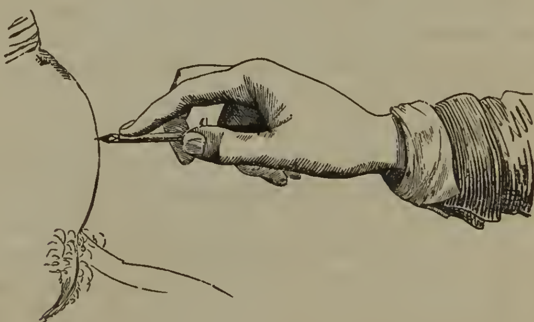
The *Anterior Tibial Artery* may be secured over the arch of the foot by an incision one or two inches long over the convex part of the foot, commencing in front of the ankle, and extending to the space between the metatarsal bones of the great and second toes; the skin and strong aponeurosis must be cut through, which will expose the tendons of the extensor pollicis and extensor longus communis muscles, and the vessel will be found lying between them close to the bones, with a vein on each side; they may then be easily separated, and the artery secured.

This vessel may also be secured above the instep by making a free incision, and searching between the tendons already named; if more than a hand's breath above the ankle, the artery will be found between the extensor communis and tibialis anticus muscles; low down, it lies on the surface of the tibia, higher up on the interosseous membrane.—*Fergusson.*

Paracentesis.

How is the operation of *paracentesis abdominis* performed? The patient is seated on the margin of a chair, the upper part of the abdomen encircled with a wide band, the middle over the stomach, and the ends made to cross behind, and each given to an assistant,

Fig. 74.



who should be directed to pull them with moderate tightness. Pass a trocar and canula into the abdomen through the linea alba, about an inch and a half below the umbilicus; then withdraw the trocar, and allow the fluid to pass through the canula; at the same time

keeping the band drawn tensely. The trocar may be pushed in by a kind of plunge, but guarded by the finger from entering too far; or the skin may be first divided with a lancet, which will render less force necessary. The wound should be closed with a strip of adhesive plaster, and the bandage placed firmly around the patient.

How is *paracentesis thoracis* performed? Patient on the margin of a bed or table, leaning slightly over on the sound side; the point selected should be the seventh and eighth rib, a little in front of the angle; draw the skin upwards so as to bring what was opposite to the lower margin on a level with the upper; make an incision through the skin, cellular texture, and intercostal muscles, until the pleura is reached, which should be opened with the point of a knife or trocar. When the fluid is evacuated and the skin let go, it will close the opening, which should always be made at the upper edge of the rib, so as to avoid wounding the intercostal vessels. Great care should be taken to prevent air from entering the cavity of the chest.

Escharotics.

What are *escharotics* or *caustics?* Substances that exert a chemical action on the materials of which the organization is composed, so as to destroy its texture. There is a great diversity in the action of different substances of this class.

What is the proper caustic to apply in cases of fungous granulations, commonly called *proud flesh?* Nitrate of silver is generally sufficient: when it is not, take verdigris, sulphate of copper, nitric oxide of mercury, of each, two drachms, bichloride of mercury, one drachm, hogs' lard, enough to blend them well together; spread this on lint, and apply. — *Brodie.*

In what manner are issues made by caustics? For this purpose, the caustic potash: or strong nitric acid, is the best. When the former is used, cut a hole in some spread adhesive plaster, of the proper size to form the sore, and apply it on the skin; rub the potash on the skin surrounded by the plaster, until it has penetrated through the skin; then discontinue it. If nitric acid is used, apply it by means of lint on the end of the probe, and rub for some minutes. If nitrate of silver is used, make it into an ointment, and

lay on the part. If the issue tends to heal, touch it occasionally with caustic potash.

Hemorrhage from Leech-bites.

How may this be *checked?* Press into the hole small pledgets of lint dipped in spirits of wine, or muriated tincture of steel, or touch them with a pointed piece of lunar caustic. Another, and an excellent mode, is to cut a small piece of common glazed card, say about the size of half a dime, and apply it to the wound immediately after wiping it, hold it firmly on the part for five minutes, and it will then adhere. If necessary, a fine stitch must be passed through each of the bleeding orifices.

Club-Foot. — Talipes.

What is meant by club foot? It is a deformity of the foot, produced by irregular muscular contraction; which may be caused by nervous disturbance, imperfect nutrition, injuries, confinement, rheumatism, &c. &c. It may be *congenital*, or *acquired.*

What are the *varieties?* There are four. *Talipes Equinus*, in which the foot rests on the ball, or the toes. The shortening is

Fig. 75.

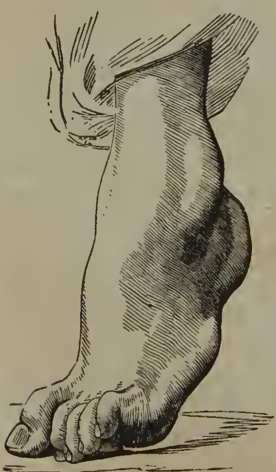


Fig. 76.

produced in this variety by the contraction of the muscles inserted into the os calcis. The plantar fascia is also thickened. (Fig. 75.)

Talipes Varus, which is the most common variety, is where the foot is turned inward and rests upon its outer edge, or on the dorsum of the foot; the heel is also raised. The degree varies greatly in different cases. There is no dislocation, properly speaking, although the bones deviate from their natural position. The tendons of the tibialis anticus and posticus, and the tendo-Achillis are most contracted, and the peronei are relaxed. The ligaments on the inner side are shortened, and those on the outer side are relaxed. (Fig. 76.)

Talipes Valgus. In this variety, the foot is everted, and rests on its inner side. The peronei muscles are contracted, and the tibialis anticus and posticus are elongated. There is relaxation of the inner ligaments. It is a rare form.

Talipes Calcaneus is a rare variety.

The foot rests on the back part of the heel.

Fig. 77.

What is the proper *treatment?* In children, the application of a proper shoe or boot. or a rectification by the proper application

of adhesive strips, will generally suffice for a cure If not, the tendons of the contracted muscles should be divided, by putting the tendon on the stretch, while a narrow, sharp-pointed knife is thrust through the skin beneath the tendon with its cutting edge towards it; it should then be brought against the tendon and withdrawn, dividing the tendon as it escapes The patient is then prepared for the proper mechanical means, to be applied in three or four days. After the foot is brought to a straight position, it requires attention and a proper shoe for a long time, to perfect a cure.

Inversion of Toe Nail.

What is the proper *treatment?* If much inflamed, poultice, and touch with nitrate of silver. As soon as the tenderness will permit, introduce some lint under the corner of the nail, to raise it from its imbedded position, after having scraped or soaked it so as to render it soft. The whole should then be enveloped by adhesive plaster. In some cases, it may be necessary to remove a portion of the nail.

PART VII.

OBSTETRICS.

PART VII.—OBSTETRICS.

The Pelvis.

Where is the pelvis *situated*, and of what is it *composed?* It is between the last lumbar vertebra and the superior extremities of the thigh bones.

It is composed of four bones in the adult; on its posterior and inferior parts by the sacrum and coccyx; and on its lateral, inferior, and anterior parts by the ossa innominata.

What are the *characteristics* of the Sacrum? It was originally composed of five pieces—its *figure* is triangular, with the base upwards; has four *surfaces*, an anterior, posterior, and two lateral; and is pierced by four holes on each side for the passage of the sacral nerves. Superiorly it is attached to the last lumbar vertebra, and laterally to the ossa innominata. Its *length* is from four to four and a half inches, *breadth* about four inches, and the *depth* of its concavity is about three-fourths of an inch.

What are the *characteristics* of the Coccyx? It is $1\frac{1}{4}$ inch in length, pyramidal, has its base upwards, articulates with the sacrum, and is composed of three or four bony portions.

What are the *characteristics* of the Ossa Innominata? They are on each side, divided into three portions, which were originally distinct—the *ilium, ischium,* and *pubes.*

The ilium on each side forms the highest lateral portion of the pelvis; the superior edge is nearly semicircular, tipped with cartilage, and called the *spine;* the external surface is convex, and called the *dorsum;* the internal is concave, and called the *fossa.* It has two anterior, and two posterior *spinous processes*, forms with the os pubis the *linea ilio-pectinea*, and with the pubes and ischium the *acetabulum.*

The Ischium is the lowest of the three bones, on each side; it terminates in a *tuber* below, from which a process runs upwards to join the pubis.

The Pubis is the smallest of the three; its longest portion forms a part of the acetabulum; it then diminishes in size, stretches over to join its fellow of the opposite side, and sends a branch downwards to unite with a portion of the ischium in such a manner as leaves an opening, the *foramen ovale.*

The innominata are joined posteriorly to the sacrum by cartilages and appropriate ligaments; the anterior junction is called the *symphysis of the pubes.*

Where are the Sacro-sciatic Ligaments situated? The *posterior* arises from the posterior inferior spinous process of the ilium, from the lower margin of the sacrum, and from the first bone of the coccyx; is inserted into the internal margin of the tuberosity of the ischium; and is extended along the internal face of the crus.

The *anterior* is placed in front, and arises from the margin of the lower part of the sacrum, and the lateral margin of the coccyx; the fibres converge, and are inserted into the spinous process of the ischium. This is the arrangement on each side of the pelvis.

How is the pelvis divided? Into the *large* and *small*, or *false* and *true;* or the pelvis above and below the brim. The line of demarcation being the linea ileo-pectinea at the sides, the crista of the pubis in front, and the promontory of the sacrum behind.

What is the distinction between the *male* and *female* pelvis? The *male* pelvis has a contracted brim of a rounded form, or triangular shape, with the promontory of the sacrum projecting. The *female* pelvis is spacious, of an oval shape, with the sacrum slightly prominent, and greater space is afforded for the passage of the child. The cavity of the male pelvis is deep, while in the female it is shallow.

In the male, there is a contracted angular arch of the pubes; in the female, there is a spacious and well-rounded arch, and the tuberosities of the ischia are much wider apart. The length of the sacro-sciatic ligament, and the mobility of the coccyx upon the sacrum serve also to distinguish the female pelvis.

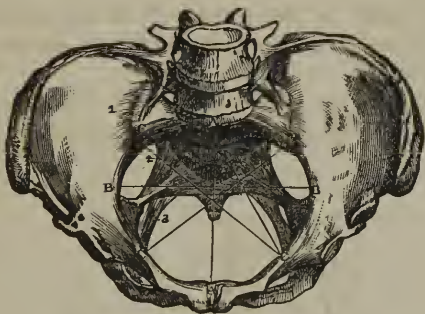
What are the parts of the pelvis the diameters of which are important? The *brim, cavity,* and *outlet.*

What are the superior and inferior openings sometimes called? The *superior* and *inferior straits.*

What are the diameters usually measured of the brim, cavity, and outlet? The *straight* or *antero-posterior;* the *transverse;* and the *oblique.*

What are the *measurements* of the *brim* or *superior strait?* The antero-posterior from the promontory of the sacrum (A) to the symphysis (A) is 4·3 inches; the transverse from the middle of the linea ilio-pectinea of one ilium (B) to the other (B) is 5·4 inches; and the oblique from one sacro-iliac symphysis (C) to the acetabulum opposite (C) is 4·8.

Fig. 1.



What are the *measurements* of the *cavity?* The antero-posterior, from the centre of the hollow of the sacrum to that of the symphysis, is 4·8 inches; the transverse, from the point corresponding to the lower margin of the acetabulum, on one side, to that of the other, is 4·3 inches; and the oblique, drawn from the centre of the free space, formed by the sacro-sciatic notch and ligaments on one side, to the foramen ovale of the other, is 5·2 inches. (Fig. 1.)

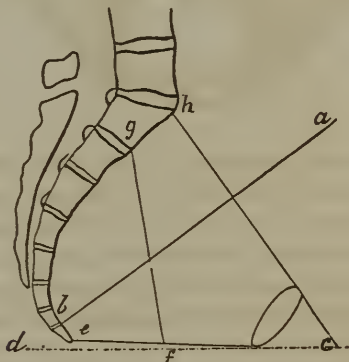
What are the *measurements* of the *outlet* or *inferior strait?* The antero-posterior, from the point of the coccyx (A) to the lower edge of the symphysis pubis (A), is 3·8 inches, but, during labor the mobility of the coccyx may allow this diameter to be increased one inch, or to 4·8 inches; the transverse, from one tuberosity of the ischium (B) to the other (B), is 4·3 inches; and the oblique, from the middle of the lower edge of the sacro-sciatic ligament of one

Fig. 2.

side (c), to the point of union between the ischium and descending ramus of the pnbes on the other (c), is 4·8 inches. — *Rigby.* (Fig. 2.) The measurements of the pelvis are reported differently by different authors.

What is meant by the *axes* of the pelvis? They are lines drawn at right angles with the planes of the straits, through their centres.

Fig. 3.



What relation does the axis of the superior strait bear to the axis of the body. It forms an angle of 135°. A line drawn from the umbilicus (*a*) to the point of the coccyx (*b*) (Fig. 3), will represent the axis of the superior strait.

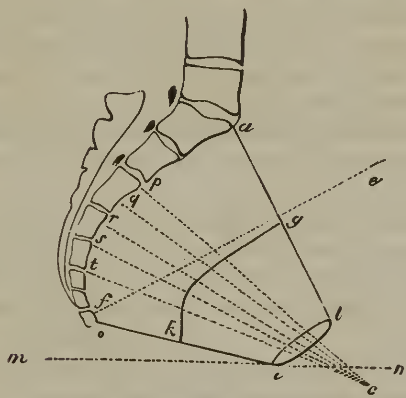
What is meant by the *inclination* of the pelvis? The angle which the axis of the superior strait forms with the horizon, when

a woman is in the upright position, marks what is called the inclination of her pelvis.

What relation does the axis of the *inferior* strait bear to the *superior?* It forms with it nearly a right angle; and is represented by a line drawn from the sacrum, just below the promontory (*g*) perpendicular to the plane of the inferior strait (*f*). The angle which the axis of one strait forms with the horizon, is inverse to that of the other. (Fig. 3.)

What is the shape of a line that will represent the axis of the pelvis? It will be a curved line (*g k*) (Fig. 4), the shape of a male catheter passing through the centre of a series of planes extending from the sacrum to the pubes, from the linea ileo-pectinea to the coccyx and sub-pubic ligament.

Fig. 4.



What is the arrangement of the two lateral inclined planes within the pelvis on each side? They are divided into *anterior* and *posterior.*

The *anterior* commences at a ridge running upwards from the spine of the ischium, extends to the symphysis pubis, passes downwards and forwards over the obturator foramen, terminating on the anterior edge of the ramus of the pubis and ischium.

The *posterior* commences at the same point, extends to the middle line of the sacrum, passes downwards and backwards behind the spine of the ischium, over the sacro-sciatic foramen, and

sacro-sciatic ligaments, terminating on the posterior edge of the tuberosities of the ischium, the lower edge of the sacro-sciatic ligament, and point of the coccyx. These planes influence the presenting part of the fœtus; when the occiput is brought in contact with the pelvis anterior to the spine of the ischium, it will pass down upon the anterior inclined plane, and emerge under the arch of the pubes; but if it enter the pelvis behind the spine of the ischium, it is liable to pass down the posterior inclined plane, rotate into the hollow of the sacrum, and emerge at the posterior commissure of the vulva.

Of Deformity of the Pelvis.

What is meant by a Deformity of the Pelvis? Any deviations from its healthy dimensions, either by excess or diminution.

What are the *evils* arising from an excess in size? Precipitation of the uterus, within the pelvis, during gestation, with its consequences; and during parturition a too rapid labor, which may cause alarming hemorrhage.

What are the *remedies* for the difficulties arising from an excess in size? For the first, a proper sized pessary, or a utero-abdominal supporter.

For the second, forbidding the woman to bear down during labor; opposing the too rapid escape of the child by pressing on its head, or the perineum of the mother; and hemorrhage may be much diminished by brisk frictions on the abdomen over the uterus, and by ergot.

What are the usual *causes* of the distortions of the pelvis? Rachitis in infancy, and malacosteon in old age.

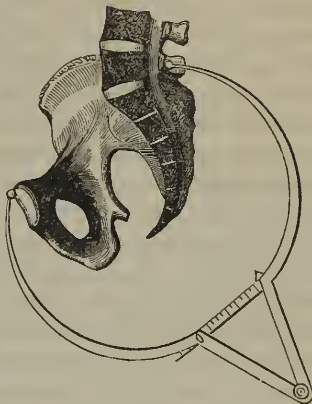
What *portion* is generally distorted? The upper strait, and this in its antero-posterior diameter; when the inferior strait is distorted, it is generally in its transverse diameter, by the approximation of the tubers of the ischia.

There is not, however, any portion but what is liable to deviation from its healthy measurements.

What is the smallest antero-posterior diameter of the superior strait that will ordinarily allow a labor to be terminated successfully to both mother and child? Three inches; if there is even three and a half, labor is rendered tedious, painful, and uncertain.

In what position would you keep a child affected with rickets, to prevent deformity of the pelvis? In a horizontal one, and permit it to exercise its limbs freely upon a bed or mattress.

Fig. 5.



To what other deformities is the pelvis liable? Exostosis and tumors.

What are the means proposed for measuring the pelvis? The *pelvimeter*, *intro-pelvimeter*, *callipers*, the introduction of the *finger* against the most projecting part of the base of the sacrum, the introduction of the hand in time of labor; and placing the fingers edgewise between the posterior part of the symphysis and the projection of the sacrum. The finger and the hand are most to be depended upon. (Figs. 5, 6, 7.)

Fig. 6.

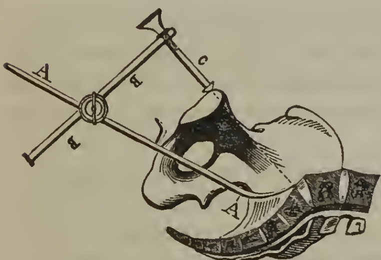


Fig. 7.

Of the Child's Head.

What are the principal *diameters* of the child's head? The *oblique*, from the symphysis of the chin to the posterior and superior extremities of the parietal bones, or the posterior extremity of

the sagittal suture, measuring 5 inches to $5\frac{1}{4}$; the *longitudinal*, from the centre of the forehead to the top of the lambdoidal suture, measuring 4 inches to $4\frac{1}{2}$; the *perpendicular*, from the summit of the head to the base of the cranium, measuring from 3 to $3\frac{1}{2}$ inches; the *transverse*, from one parietal protuberance to the other, measuring from 3 to $3\frac{1}{2}$ inches; and the *cervico-bregmatic*, extending from the occipital bone, near its junction with the spine, to the anterior fontanelle, measuring from 3 to $3\frac{1}{2}$ inches.

Are these diameters ever altered during the progress of labor? They are liable to be from the suppleness of the bones of the head of the fœtus; but all cannot be diminished or increased at the same time; if one is diminished, another must be increased. The extent to which these changes may take place varies in individual cases, owing to the more or less perfect ossification of the bones.

What are the *sutures* of the fœtal head which are interesting to the accoucheur? The *sagittal*, or the line of union from the occipital bone to the root of the nose, connecting the parietal and the two sides of the frontal bone with each other; the *coronal*, which connects the anterior portions of the parietal and the posterior portions of the frontal bone; the *lambdoidal*, which connects the posterior portion of the parietal and the anterior portion of the occipital bones.

What forms the *anterior* or *bregmatic fontanelle*, and how is it distinguished? It is formed at the points of decussation of the sagittal and coronal sutures. It is distinguished by four bony angles, the edges of which are tipped with cartilage, and are smooth, soft, and yielding.

What forms the *posterior fontanelle*, and how is it distinguished? It is formed at the points of junction of the posterior end of the sagittal with the centre of the lambdoidal suture, and has three bony angles; two by the parietal, and one by the occipital bones.

What parts of the head are of most importance to understand, in order to determine the presentations? The *sutures* and *fontanelles*.

To what extent may the head be rotated on the trunk with safety to the *child*? One quarter of a circle, and not more.

Of the Genital Organs. *See* Anatomy.

Menstruation.

What is meant by Menstruation? It is that function in which the uterus periodically secretes a sanguinolent fluid, accompanied by the evolution of an ovule from the ovaries, which is a matured Graafian vesicle.

What part gives *origin* to this secretion? The internal coat of the uterus.

What are the *characteristics* of this secretion? It resembles blood, has a peculiar quality and odor; it is not coagulable, nor does it putrefy readily.

At what *period* does menstruation take place? It takes place at puberty, or that period at which the animal is capable of propagating its species; the age varies under the influences of climate, constitution, and modes of life; earlier in hot than cold countries, sooner in cities than in the country, &c.

What are the *symptoms* which precede menstruation? The mammæ increase in size, the voice is changed, the pubes are covered with hair, the best proportions are developed, and the mind is rapidly matured.

Besides these, there is generally headache, dulness of the eyes, pains in the pelvic region, lassitude, whimsical appetite, leucorrhœa, &c., which gives place to a discharge from the vagina.

What is the *menstruous period?* From four to six days; and during this time from four to six ounces of fluid are discharged.

What are *general symptoms* during the menstrual flow? The appetite becomes capricious, the person is languid, pale, or hectically florid, dark under the eyes, and frequently there is a dragging sensation about the hips and loins.

At what *age* does it cease? From forty-five to fifty. In this climate at about forty-six or seven.

Does the regular appearance of the menses, in a healthy manner, every twenty-eight days, indicate a capability for procreation or reproduction? It does.

Is the uterus influenced by any of its appendages in this function? The ovaries appear indispensable to it; as their absence, either natural or by removal, prevents the appearance of the menses.

Is menstruation a physiological or a pathological condition? It is strictly a physiological function.

Is the *cause* of menstruation well understood? It is not; there have been many theories formed to account for it, but they are not entirely satisfactory.

Derangement of the function of Menstruation.

To what derangements is this function liable? To a *too tardy appearance* of the menses.

To its *interruption* after having been established.

To *excess* of quantity.

To *menorrhagia*

To *dysmenorrhœa* or *painful* menstruation.

And to *irregularities* towards the decline of life.

At what period of life, in this country, does menstruation take place? From the fourteenth to the fifteenth year.

Does age of itself present an indication for interference in regard to this function? No; there should be other evidences of womanhood; and when these are absent, the girl should never be tortured by emmenagogues. These signs are enumerated under the head of Menstruation.

What should be done where these signs to a greater or less extent exist, and menstruation does not appear, with a delicate state of health of the patient? There should be a regular course of exercise instituted when the patient can bear it; such as riding on horseback, walking, skipping the rope, &c. The dress should be attended to; and the diet should consist of easily digested food, both animal and vegetable; all stimulating drinks should be avoided. Tincture of cantharides, particularly if leucorrhœa attends, may be given in doses of thirty drops, three times a day. Keeping the bowels regularly open with aloetic pills, with or without the sulphate of iron, is beneficial. When anæmia or chlorosis exists, the carbonate of iron, in large doses, is a very reliable remedy.

What is to be done when a chronic disease exists? Attention should be given to the disease when we have reason to suppose the absence of the menses depends upon it.

What is understood by *suppression* of the menses? It is the want of return of this discharge at the accustomed period, after it

has been established, when not interrupted by pregnancy or suckling.

What are the *causes?* Cold, applied either in the interval or during the flow.

What are the *symptoms?* Paleness, emaciation, debility, nervous symptoms, palpitation of the heart, difficulty of breathing, and a disturbance of the circulation; to which may be added fluor albus, and more or less pain in the loins and pelvis.

What is the *treatment?* It will depend upon the state of the circulation; if the pulse is disturbed, we should prescribe blood-letting, purging, low diet, &c., until it is corrected; and then we can safely give emmenagogues; among these aloetic and ferruginous pills, the ammoniated tincture of guaiacum and carbonate of iron, stand first.

What is understood by *dysmenorrhœa?* It is a menstruous discharge, accompanied by pain of a forcing and bearing down kind, and a discharge of membranous substance or coagula.

What is the *treatment?* During the paroxysms, the pain should be relieved by anodynes and antispasmodics, such as camphor, and camphor and opium, with perfect rest. In the intervals, use alteratives and tonics after proper depletion. The *pathological condition* of the uterus and its appendages should be attended to in all cases.

PREGNANCY.

What *changes* take place after the period of impregnation? The ovum increases in size, and is prominent on the ovarium; absorption of its peritoneal coat takes place; it is embraced by the fimbriated extremity of the Fallopian tube, and carried towards the cavity of the uterus.

At what *time* is the ovum found in the uterus? Probably about twenty days after impregnation.

What is the *appearance* of the ovarium after the ovum is removed? First, an effusion of blood into the cavity from whence the ovum was removed, and this is followed by a true corpus luteum.

THE MEMBRANES, &C.

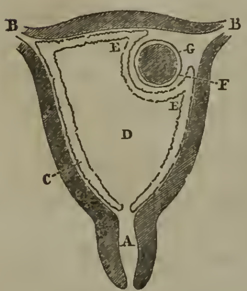
What takes place during this time in the cavity of the uterus? The internal surface throws out a vascular tissue, which is termed

the *membrana decidua;* it lines the cavity of the uterus down to the internal os uteri, remains next to it during pregnancy, and forms the medium of contact between the uterus and the ovum.

What are the *membranes* of the ovum? There are two; the *chorion* externally, and the *amnion* internally. They enclose the embryo and the water in which it floats.

What takes place when the ovum arrives at the uterus? The ovum adheres to the decidua (C), and causes a growth of that part with which it comes in contact, and is called the *decidua reflexa;* so that the decidua is then divided into that portion lining and in contact with the uterus, called *decidua vera* (C); and that portion in contact with the ovum, and called *decidua reflexa* (E E); this arrangement corresponds with that of the pleura pulmonalis and costalis; they come in contact about the fourth month.

Fig. 8



What are the *uses* of the amnion and chorion? The amnion furnishes a quantity of fluid for the protection of its contents; the chorion furnishes a means of communication with the uterus, and is thought by some to form the basis of the placenta.

What then does the ovum consist of after its establishment within the uterus? The *decidua, decidua reflexa, chorion, amnion, liquor amnii, fœtus,* and *umbilical cord,* with one extremity attached to the umbilicus of the child, and the other to the membranes, which for the present answers the purpose of the placenta.

What are the *uses* of the liquor amnii? Perhaps its uses are not entirely known; but it allows space, and facilities for motion, development, &c , of the fœtus.

What *composes* the umbilical cord? It consist of two arteries, a vein, a layer of amnion, and perhaps also the chorion; the arteries are a continuation of the primitive iliacs; the vein passes under the edge of the liver, and enters the vena cava.

The Placenta.

What is the placenta and its *characteristics?* It is that vascular mass by which the circulation is maintained between mother and

child, and the latter is nourished. Its diameter is six or eight inches, and its thickness is from a few lines at its edge to one inch or more at its centre. It has two surfaces; the *uterine*, which is rough, spongy, traversed by sulci (and it is believed by many that the decidua lines its whole surface); and the *fœtal*, which is smooth, and lined by the amnion.

Fig. 9.

Fig. 10.

What is the *structure* of the placenta? It is essentially vascular; the vessels being connected by weak tissue analogous to cellular.

These vessels are dependencies of the vascular systems of both mother and child, but have no direct connection with each other.

Suppose an injection passed into the umbilical arteries, what becomes of it? It passes into the veins of the placenta, and the whole plexus may be filled. The arteries may be filled in the same manner, by injecting the umbilical vein.

Can an injection be passed into the fœtal vessels from the uterine arteries? It cannot.

What are the *functions* of the placenta. It is an absorbing and respiratory organ to the fœtus.

What is meant by *embryo*? It is the new being during the first three months of gestation; during the balance of its intra-uterine existence it is called fœtus.

The Fœtal Circulation

What are the peculiarities of the circulatory apparatus of the fœtus? There are five: 1st. The *vena umbilicalis*. 2d. The *duc-*

tus venosus. 3d. The *foramen ovale*. 4th. The *ductus arteriosus*. 5th. The *arteriæ umbilicales*.

What is the *Vena Umbilicalis?* It arises from the placenta, enters the abdomen through the navel, passes along the anterior margin of the suspensory ligament of the liver, is connected with the sinus of the vena portarum, and a great portion of its blood is distributed to the liver.

What is the *Ductus Venosus?* It arises from the vena portarum, and empties into the vena cava; it arises directly in the face of the umbilical vein, so that a probe may pass readily from one to the other, and might be considered as a continuance of it.

What is the *Foramen Ovale?* It is a large aperture between the two auricles of the heart, furnished with a valve, which closes when respiration begins.

What is the *Ductus Arteriosus?* It is a canal leading from the pulmonary artery into the aorta, and discharges into the aorta, at the lower part of the curvature.

What are the *Arteriæ Umbilicales?* They are two in number, and are a continuation of the external iliacs; they pass through the navel, in company with the umbilical vein, twist spirally around it, and are distributed to the placenta.

What is the *course* of the fœtal circulation? It is from the placenta through the umbilical vein and ductus venosus into the ascending cava, which discharges the blood into the right auricle of the heart. The eustachian valve turns the greater part of the blood into the left auricle, through the foramen ovale. The left auricle may then be said to be distended with blood from the ascending cava, while the right is distended with the blood of the descending cava. The auricles contract together, and fill the ventricles. The ventricles also contract together and fill the pulmonary artery and aorta. The blood of the right ventricle, having got into the pulmonary artery, is principally discharged by the ductus arteriosus into the descending aorta. That of the left side, by being driven into the aorta, is mostly sent through the arteria innominata, the left carotid, and the left subclavian, to the head and upper extremities; what remains, being mixed with the contents of the descending aorta, goes to the lower extremities; but by far the greater portion of the blood of the descending aorta passes through the umbilical arteries to the placenta, where it is

rendered fit for the nutrition of the fœtus, taken up by the umbilical veins, and repeats the same round until respiration is established.

Changes in the Uterus from Impregnation.

What are the changes which take place in the parietes of the uterus itself from impregnation? There is an increased quantity of blood sent to it, which increases with gestation; the vessels, from being small and convoluted, become enlarged and straighter.

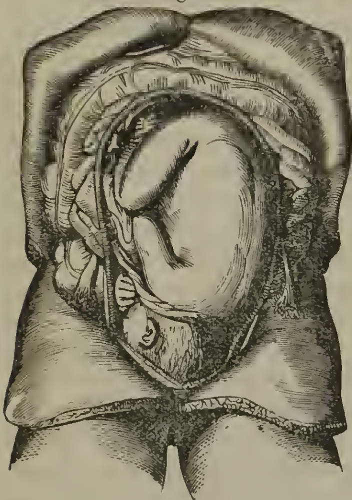
The fibres of the uterus, and all the structures entering into its composition become developed, so as to be recognised as muscular; the organ increases in size with perfect regularity, and its position and distension give us a pretty accurate knowledge of the advancement of pregnancy. For the first three or four months the uterus is found lower in the vagina than when unimpregnated; after the fourth or fifth month, the fundus can be felt at the pubic region; at the sixth, half way between it and the umbilicus; at the seventh, at the umbilicus; at the eighth, half way between the umbilicus and the scrobiculus cordis; at the ninth, about the same, owing to the more perfect development of the neck. The neck of the uterus undergoes changes also after the sixth month; it becomes shorter and shorter, and at the ninth month is entirely obliterated; furnishing then the principal increase of space for the fœtus. Of the body and fundus, the posterior portions contribute the most space, and hence the Fallopian tubes at the latter part of pregnancy are found in advance of the uterus.

Of the Development of the Fœtus.

In what order is the product of conception developed? To the fifteenth day it is a gelatinous, semi-transparent, flocculent, grayish mass; at thirty days, it is the size of a large ant, varying from three to five lines in length; at six weeks, it is ten lines in length, about the size of a bee, and some of the rudiments of organs are visible; at two months, it is about two inches long, the weight is two ounces, and ossification has commenced in some parts; at the third month, it is about three and a half inches long and weighs nearly three ounces, the umbilical cord is formed, and the genital organs are distinct; at the fourth month, it is from five to six inches long, and weighs from four to five ounces.

During the fifth month, motion is perceptible by the mother, the length is from seven to nine inches, and the weight nine or ten ounces; at the sixth month, the parts are more perfectly developed, it weighs from one to two pounds, and its length is from nine to twelve inches.

Fig. 11.



At the seventh month, all parts are more perfectly developed; the eyelids, which until now have been united by the membrana pupillaris, are separated; the hair and nails grow, the weight is from two to three pounds, and the length is from twelve to fourteen inches. At eight months, the weight is from three to five pounds, the length sixteen inches or more, and all the parts show a much more perfect condition of development. At the ninth month, the head has considerable firmness, ossification is more complete, all the organs are capable of performing their appropriate functions in a more perfect manner; the length of the fœtus is about 20 inches, and the average weight is about 7 pounds in this country.

Extra-Uterine Pregnancy.

What are the *varieties* of extra-uterine pregnancy? *Ovarian pregnancy*, or when the embryo is developed in the ovary.

Ventral or *abdominal* pregnancy, when the embryo becomes deposited and developed in the cavity of the abdomen.

Tubal pregnancy, or when the embryo becomes developed in the tube.

Interstitial pregnancy, or when the ovule becomes deposited between the layers of the muscular fibres of the uterus and is developed.

What are the *consequences* of extra-uterine pregnancy? The

consequences are usually serious: irritation, inflammation, suppuration, ulceration, internal hemorrhage, and sloughing are all liable to happen, and often to the extent of causing death to the mother.

What is the proper *treatment?* Generally, a palliative treatment is the best.

Gastrotomy has been recommended by some authors.

Of the Signs of Pregnancy.

How are the signs of pregnancy *divided?* Into the *rational* or *sympathetic*, and the *positive*, or *physical* signs.

What are the *rational signs* of pregnancy? Suppression of the menses; the nipples and papillæ become enlarged, tumid, dark-colored, and surrounded by an areola, morning sickness; enlargement of the abdomen, &c.

Are these signs *positive?* No; they are all fallacious, and may be produced by other causes than pregnancy.

What is the mode of examination to detect the *physical signs?* The examination of the abdomen by the hand, by auscultation, and ballottement.

What do we detect by an examination of the abdomen with the hand? The form of the tumor, and the movements of the fœtus.

What may be detected by *auscultation?* The pulsations of the fœtal heart, and the uterine souffle, and to these may be added the movements of the fœtus.

Is the *uterine souffle* a sign to be invariably relied upon? No; it is valuable, but not conclusive.

Are the *pulsations of the fœtal heart* to be relied upon? They are conclusive when heard; which can almost invariably be done when pregnancy exists, after the fourth month, although at this early period great care is required. The point where it may often be heard is about midway between the scrobiculus cordis and symphysis pubis, or perhaps more frequently a little to the left of the middle line. These pulsations may be distinguished by their quickness, which are from 130 to 150 in a minute. In cases of double pregnancy, the sound of both fœtal hearts may mostly be heard in the last weeks of pregnancy.

What is meant by *ballottement*, and what is its importance as a

diagnostic of pregnancy? The process of ballottement is performed by passing the finger to the mouth of the uterus, or midway between it and the symphysis pubis, while the other hand is applied upon the abdomen to the fundus; the finger should be suddenly pushed up against the uterus, while the palm of the other hand is placed on the abdomen to receive any impression which such a shock may produce; the finger in the vagina is to be kept applied to the uterus, so that it may determine whether any floating body descends upon it. By these means we can determine whether the uterus contains a floating body; but it does not give us absolute knowledge of what that floating body consists. The woman should be in the erect position.

Are there any other *symptoms* of pregnancy? Yes; the presence of *kiestine* in the urine is looked upon as affording a symptom of value, not always to be depended upon, however, as it may exist in certain diseases; but, taken in connection with other symptoms, it may be valuable in coming to a conclusion.

A Table exhibiting the Signs of Pregnancy at the different Periods

RATIONAL SIGNS.	SENSIBLE SIGNS.
	First and second months.
1. Suppression of the menses (numerous exceptions).	1. Augmentation in the size and weight of the uterus.
2. Nausea — vomiting.	2. Descent of the organ.
3. Slight flatness of the hypogastric region.	3. The womb is less movable.
4. Depression of the umbilical ring.	4. Its walls have the consistence of caoutchouc.
5. Tumefaction and tenderness of the breasts.	5. The neck is directed downward, forward, and to the left.
	6. The orifice of the os tincæ is rounded in primiparæ, but more patulous in others who have had children.
	7. A slight softening in the mucous membrane covering the lips, and this membrane appears œdematous.
	Third and fourth months.
1. Suppression of the menses (a few exceptions).	1. The fundus uteri rises to the level of the superior strait towards the end of the third month, and is perceived at the close of the fourth about the middle of the space between the umbilicus and pubis.
2. Frequently, the apparation or the continuance of the vomitings.	2. A perceptible flatness on percussion in the hypogastric region.
3. A small protuberance in the hypogastric region.	3. A rounded tumor, as large as a child's head of a year old, may be detected there by the abdominal palpitation.
4. Less depression of the umbilical cicatrix	4. By resorting to this process and the vaginal touch jointly, the displacement en masse, and the volume of the uterus may be easily ascertained.

RATIONAL SIGNS.	SENSIBLE SIGNS.
	Third and fourth months — continued,
5. Augmented swelling of the breasts, prominence of the nipples, and sligbt discoloration in the areola.	5. The neck has the same situation and direction during the third month, as in the preceeding ones; at the fourth it is elevated and directed backwards and to the left side.
6. Kiesteine in the urine.	6. The ramollissement of the periphery of the orifice is much better marked. The latter is more open in *multiparæ*, even admitting the extremity of the finger; but it is closed and always rounded in primiparæ.

Fifth and sixth months.

RATIONAL SIGNS.	SENSIBLE SIGNS.
1. Suppression of the menses (some rare exceptions).	1. Tbe fundus uteri is one finger's breath below the umbilicus at tbe end of the fifth month; and the same distance above it at the expiration of the sixth.
2. The disturbances in tbe digestive organs generally disappear.	2. Fœtal irregularities, and active movements, which are very perceptible.
3. Considerable developmeut of the whole sub-umbilical region.	3. The bruit du cœur and bruit de soufflet are now perceptible.
4. A convex, fluctuating, rounded abdominal tumor, salient, particularly on the middle line, and sometimes exhibiting tbe fœtal irregularities.	4. Ballottemeut.
5. The umbilical depression is almost completely effaced.	5. A tumor is felt at the anterior-superior part of the vagina, wbich is sometimes soft and fluctuating, at others rounded, hard, and resisting.
6. The discoloration in the areola is deeper — glandiform tubercles; areola spotted.	6. The inferior half of the cervix uteri is softened.
7. Kiesteine in the urine.	7. Tbe whole ungueal part of tbe first phalangeal bone can penetrate the cavity of the neck in *multiparæ*. The latter is softeued to tbe same extent iu primiparæ, but tbe orifice is closed.

Seventh and eighth months.

RATIONAL SIGNS.	SENSIBLE SIGNS.
1. Suppression of the menses (the exceptions are very rare).	1. Increased size of the abdomen.
2. Disorders of the stomach (very rare).	2. The fundus uteri is three fingers' breadth above the umbilicus at the seventh month, and four or five at tbe eighth.
3. The abdominal tumor has tbe same characters, except that it is more voluminous.	3. The organ is nearly always inclined to the right.
4. A complete effacement of the umbilical depression, the dilation of tbe ring, and sometimes a pouting of the navel.	4. More violent active movements of the fœtus.
5. Numerous discolorations on the skin of the abdomen.	5. Bruits du cœur and de soufflet.
6. Sometimes a varicose and œdematous condition of the vulva and inferior extremities.	6. Ballottement is very clear during the seventh month, but more obscure in the eighth.
7. Vaginal granulations — abundant leucorrhœal discharge.	7. The ramollissement extends along the neck, above the vaginal insertion. In primiparæ, the cervix is ovoid, and seems to have diminished in length; in others it is conoidal, the base being below, and sufficiently patulous to admit all the first phalanx. The neck and its superior fourth is still hard and shut up.
8. Deeper discoloration of the central areola, and an extension of the spotted areola. Sometimes there are numerous stains on the breasts; flow of milk; complete development of the glandiform tubercles.	
9. Persistence of kiesteine iu the urine.	

RATIONAL SIGNS.	SENSIBLE SIGNS.
First fortnight of the ninth month.	
1. The vomitings frequently reappear.	1. The fundus uteri reaches the epigastric region, and gains the border of the false ribs on the right side.
2. The abdominal tumor has increased — the skin is much stretched, and very tense.	2. Active movements. Bruits du cœur and de soufflet.
3. Difficulty of respiration.	3. Often there is no proper ballottement, but merely a kind of rising of the tumor formed by the head.
4. All the other symptoms persist, and are increased in intensity.	4. The neck is softened throughout its whole length, excepting the circumference of the internal orifice, which still remains closed and resisting. In women, who have previously borne children, the finger may be introduced into the cervix to the extent of a phalanx and a half, and in fact is only arrested by the internal orifice, which is closed and wrinkled, though in some cases already beginning to open. In primiparæ, the ramollissement is equally extensive, and the neck is swollen in the middle in an ovoidal form, but the external orifice, although partially opened, does not permit the introduction of a finger.
Last fortnight of the ninth month	
1. The vomitings often cease.	1. The fundus uteri has sunk lower than in the first fortnight.
2. The abdomen is fallen.	2. Active movements; bruits du cœur and de soufflet.
3. The respiration less oppressed.	3. Ballottement often imperceptible.
4. More difficulty in walking.	4. The head more or less engaged in the excavation.
5. Frequent and ineffectual desires to urinate.	5. In *multiparæ*, the internal orifice softens and dilates; the finger can then penetrate through a cylinder (as it were) an inch and a half in length, and come in contact with the naked membranes. In *primiparæ*, the internal orifice experiences the same modification, but the external remains closed. During the last week, in consequence of the spreading out at the internal orifice, the whole cavity of the neck becomes confounded with that of the body, and the finger, in reaching the membranes, only traverses a thin orifice in primiparæ, but a rounded collar in others, of a variable thickness. — *Cazeaux.*
6. Hemorrhoids; augmentations of the œdema and varicose state of the lower extremities.	
7. Pains in the loins, and colics.	

Treatment during Pregnancy.

What is the proper *treatment* during pregnancy? All excitement should be avoided; the exercise should be moderate, and of a kind calculated to invigorate the general health; the diet should be simple and unirritating; and both diarrhœa and costiveness should be avoided or relieved. Castor oil, or pills of rhubarb and soap, form the best aperient. Sickness of the stomach may often be relieved by lime-water and milk. Any complication occurring should receive its appropriate treatment.

ABORTION.

What is understood by abortion? The expulsion of the ovum at any period prior to the sixth month: after that period, it is termed *premature labor.* The *causes* may be violent mental emotions; the effects of habit; anything which increases the velocity of the circulation of the blood; diarrhœa, syphilis, acute disease of the mother, venery, violent exercise, blows on the abdomen, strong purges, &c., &c.

What are the *signs* of abortion? Absence of the morning sickness, which also very often occurs when the fœtus is dead; when this exists, we may infer that the child is alive; flaccidity of the breasts; tenesmus, pains of the back, abdomen, and weight and pain in the region of the uterus, expulsive pains, and hemorrhage; this last symptom cannot exist without the separation of a portion of the ovum.

What are the means of its *prevention?* In plethoric women, use small and repeated bleedings, with a general antiphlogistic course. Weak women require, on the other hand, tonics, wine, bark, and cold bathing. Violent exercise should be avoided, the mind kept composed, and mild aperients used, but purging should be carefully avoided.

What is the proper *treatment?* Bleeding when plethoric, cooling and saline draughts with laudanum proportioned to the amount of pain, keep the patient cool. Laudanum, opium, or morphine will often, when given in full doses, either by the mouth or by the rectum, quiet the symptoms and put a stop to its further progress, unless considerably advanced. Entire rest should be strictly enjoined, and, if hemorrhage exist, acetate of lead should be given, and ice used internally and externally, and the vagina plugged if necessary.

The best *tampon* or *plug* is probably formed by what is termed the *kite-tail plug,* which consists of small strips of soft muslin, united together by a small cord The tampon should only be used when there is little or no hope of saving the contents of the uterus, and hemorrhage exists; ergot may be given with propriety, under the same circumstances, for the purpose of hastening the expulsion of the ovum.

Of the Action of the Uterus.

What are the *actions* of the uterus? It has two. The first tends to reduce it to its original size, after having been distended; this is called its *tonic* action. It is accomplished by all the fibres gathering themselves to a common centre, but particularly by the circular fibres.

The second acts only when attempting to expel something, and is *alternate* in its action; it has been termed the *spasmodic* or *painful* contraction of the uterus; and never takes place unless the tonic action is perfect, or nearly so.

Retroversion of the Uterus.

What is meant by Retroversion of the uterus? It is where the fundus is precipitated backwards, and places itself between the rectum and bladder; while the neck is mounted up behind the symphysis pubis.

At what time may this displacement take place? Either in the unimpregnated or the impregnated state; but usually in the latter. It occurs mostly between the second and fourth months of pregnancy.

What are the *causes?* Whatever tends to depress the fundus; such as blows, pressure, sudden exertion, violent efforts to vomit, coughing, an over-distended bladder, and an accumulation of feces in the rectum.

What are the *symptoms?* When suddenly produced, the symptoms may be severe; and immediate interruption to the flow of urine, or to the passage of the feces, alternate pains, bearing down, disposition to faint, &c. When slowly induced, the symptoms are the same, only less urgent and severe, but increase in intensity as the uterus is developed, until relieved. The diagnosis should be verified by the touch; and the disease may easily be distinguished by the vagina interposing between the finger and the tumor, the neck being mounted up behind the symphysis, and by its being obstinately fixed in its position.

What is the *treatment?* The catheter should be used, and the bowels emptied daily; if this plan does not succeed, it should be

replaced by mechanical means. The plan then to be pursued is to empty the bowels, either by injections or a cathartic; draw off the urine with an elastic catheter; and bleed to fainting, or nearly so, if necessary. The bed should be prepared in such a manner that the patient may lie upon her back, with the perineum free from the edge of the bed, and the parts should be well lubricated with oil or lard. When faintness is induced by bleeding, the woman should be placed in the above position; the fingers should be placed so as to form a straight line at their extremities; they must then be gently pressed against the base of the tumor in the vagina so as to move it backwards and upwards, along the hollow of the sacrum, until it is placed above the projection of this bone; the hand should be withdrawn, a pessary introduced, and the woman kept quiet in bed for some days. It has also been recommended to place the patient under the effect of chloroform, and attempt reduction when in this condition.

Anteversion of the Uterus.

What is Anteversion of the uterus? It is where the fundus is thrown forward and downward, so as to press against the posterior and inferior portion of the bladder, while the neck is carried backwards towards the projection of the sacrum. The symptoms are not so severe as in retroversion. It may generally be relieved by opening the bowels and drawing off the urine.

Of the Obliquities of the Uterus.

How are they *divided?* Into right and left lateral, and the anterior.

What is the *treatment* for these displacements of the uterus? Before labor, the woman should wear a bandage or supporter.

During labor, the axes of the uterus and pelvis should be made to correspond, by placing the patient on the side opposite to the obliquity, and bringing the fundus into its proper place. If this does not accomplish the object, the os uteri should be hooked down by the finger, and brought to correspond with the axis of the pelvis.

Of the Term of Utero-gestation.

What is the average *term* of utero-gestation? About nine calendar months, or forty weeks.

What is the most favorable *period* for conception? Immediately after the menstrual evacuation.

Of Labor.

What is understood by the term Labor? It is the expulsive efforts of the uterus and mother in evacuating the contents of the uterus.

Is its exciting *cause* well understood? It cannot be explained in the present state of our knowledge.

Has the *mind* any influence on labor? Mental impressions may excite labor in some cases, and in others suspend or prevent it.

Is the fœtus *active*, or *passive* during labor? It is entirely passive; being acted upon by the uterus mainly, assisted by the voluntary powers of the mother.

What are the *symptoms* of labor? They are rigors, and nervous symptoms, frequent inclination to make water, or a suppression of it, tenesmus, the subsidence of the abdominal tumor, secretion of mucus, dilatation of the mouth of the uterus, and its alternate contractions.

What is understood by *false pains*? The pains are false when the os uteri is entirely unaffected by them; which may be ascertained by an examination. When these occur, they should be quieted by an injection of laudanum with starch, sufficient in quantity to accomplish the object, after evacuating the bowels.

By what set of fibres is the os uteri opened? By the *longitudinal*, which are opposed by the *circular*.

Into how many *stages* is labor divided? Three. The *first* is the *period of dilatation* of the os uteri sufficient to permit the child to pass, and occupies about ten-twelfths of the whole duration of labor. (Fig. 12.)

The *second* is the *period of expulsion* of the child from the uterus, and occupies about one-ninth. (Fig. 13.)

The *third* stage includes the *complete expulsion of the mem-*

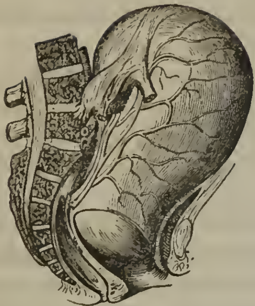


Fig. 12.

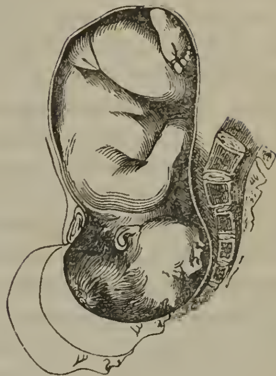


Fig. 13.

branes and placenta, and occupies about one-twenty-fourth of the whole duration of labor.

Are the active duties of the accoucheur numerous in a natural labor? No; he should watch with care its progress and attending symptoms, so as to be able to render assistance promptly in case of difficulty; but should not interfere when the case is a natural one. To be able to discriminate where interference is necessary, requires an accurate knowledge of a healthy labor, and the deviations to which it may be liable.

What should be the *position* of the woman during labor? She should be placed on her left side at the foot of the bed, in such a manner that she may fix her feet firmly against the bedpost; her hips within ten or twelve inches of the edge of the bed, with the lower extremities fixed, and the head supported by pillows.

The bed should be properly protected by folded blankets from the discharge.

What *time* would you choose for making an examination of the progress of labor? The finger should be introduced into the vagina during a pain; the examination of the presenting part and of the condition of the os uteri should be made both during pain and in its absence.

Should the membranes be ruptured during labor? When the membranes remain entire, and the pains are efficient, with the os uteri fully dilated or dilatable, they should be ruptured by pressing the finger against them, or by cutting them with the nail.

When the head is emerging under the arch of the pubes, what are the duties of the accoucheur? He should support the perineal tumor with the palm of the left hand, and retain it there until the head is freed from the vulva.

When the head is in this position, is it proper to act upon it, and extract the fœtus? No; the delivery should be trusted to the action of the uterus, unless it should become suspended, and there is danger of the life of the child. By a too sudden delivery, alarming hemorrhage may result.

What is the first great object as regards the child after delivery? To establish respiration, which generally takes place spontaneously; if it does not, measures should be taken to produce artificial respiration; and heated cloths should be applied to the child rather than the warm bath. The sudden application of cold water will often excite respiratory efforts very efficiently.

What are the means employed in producing *artificial respiration?* The nostrils should be closed, and air forced into the mouth either by the bellows, or from the mouth of the accoucheur; and again expelled by gently pressing upon the thorax.

To what period after birth may respiration be suspended, and yet the child live? For thirty, or even forty minutes in some instances; so that our efforts should be continued so long as there is any chance of life.

At what time is it proper to put a ligature on the cord, and cut it? When the child cries, or respires freely; and there is evidence of a proper supply of arterial blood.

How many ligatures are necessary? One; except there be twins, in which case two are necessary.

After the child is separated from the mother and given to the nurse, what should then be attended to? The condition of the uterus should be ascertained by examining it through the parietes of the abdomen, when it will be found either contracted or relaxed.

If contracted, the placenta may be in the vagina, and easily hooked down with the fingers, and drawn by the cord; when it has passed the os externum, it shall be grasped and twisted several times round, so that the membranes may be entirely withdrawn.

If the uterus is relaxed, frictions should be made over the abdomen so as to produce contraction.

The condition of the uterus should be watched until its permanent tonic contraction is well established.

If there is a retention of the placenta after tonic contraction has taken place, rubbing and pressing the belly may excite a greater degree of it, or, perhaps, alternate contraction sufficient to expel the placenta: but if this does not take place, the hand may be introduced, after waiting an hour or two, which should then be done by introducing it into the uterus in the form of a cone; the placenta should be carefully detached, without leaving any portion behind, and the hand may be slowly withdrawn.

What is understood by putting the patient to bed? It consists in the removal of wet things and substituting dry ones; in being lifted where she is permanently to lie; and in the application of a bandage and compress over the abdomen.

At what time should it be done? If she is not in a profuse perspiration, is not liable to, or has no hemorrhage, and the uterus well contracted, or not much exhausted, it should be done immediately.

Upon what do *after-pains* depend, and what is the remedy? After-pains are produced by coagula in the uterus, which are caused by a deficiency of its tonic contraction. The proper remedies are evacuation of the bowels, camphor, opium and its preparations, and the extract of hyoscyamus.

What should be the *diet* of a woman after delivery? Gruel of oatmeal, tapioca, sago, mush and milk, rice, crackers, toast, weak tea, coffee, and chocolate. Animal food, spirits, wine, cordials, and all stimulating articles should be strictly avoided, unless rendered necessary by an exhausted condition of the system. After the first week, she may be allowed some oysters, eggs, beef tea, &c.

When should the child be put to the breast? If there is danger from hemorrhage, it should be applied as soon as possible; and at any rate as soon as it can be done conveniently without too much annoyance to the woman.

If the bowels should be confined, at what time would it be proper to give a cathartic? On the third day; previous to this, unless there is some particular indication to fulfil, the bowels should not be disturbed.

The state of the bladder should also always be attended to.

What is meant by the *lochi?* The discharges which take place from the uterus after delivery.

Is it necessary to administer purgatives to young children? It is necessary that the bowels should be thoroughly cleansed of the meconium, either by their natural action, or by some laxative as molasses or castor oil; but as soon as there is a change of color produced in the evacuations, they should be discontinued.

The condition of the bladder of the child should also be attended to, and relieved if urine should accumulate in it.

Is it proper to feed very young children? Provided the mother does not furnish a supply of milk sufficient, but not otherwise; the child may then have a little fresh cow's milk, diluted with one-third water, and sweetened with loaf sugar.

Laceration of the Perineum.

What *preventives* may be adopted to avoid laceration of the perineum during labor? Support should be given to the perineum during the passage of the child's head and shoulder out of the vagina, by placing the palm of the hand firmly against it, and so cause the head to descend downwards and forwards.

What is the proper *treatment* when it occurs? When recent, efforts should be made to unite the parts by the first intention, and to accomplish this the patient should keep quiet, with her limbs close together. Surgeons direct the employment of sutures, provided the laceration is extensive, and *particularly* if the sphincter ani is lacerated. When the case is of some standing, or the parts indisposed to heal, the edges should be pared as in the hare-lip operation, and brought together so as to form a union.

Sore Nipples.

What is the proper *treatment?* Reduce the inflammation by general and local means; use Pratt's artificial nipple and shield, and if the ulcerations become deep and chronic, touch them with nitrate of silver lightly. The above artificial nipple of Pratt's may be used with little or no pain, causes but slight disturbance of the sores, and of course, the principal impediment to cicatrization is thus removed. Gentle astringent washes, in the chronic stage,

are also beneficial; of these, the sulphate of zinc and the tincture of catechu are proper remedies. Previous to labor, the nipples should be often washed with a strong solution of tannin as a preventive.

Of Natural or Unassisted Labor.

What is meant by a *natural labor?* Every labor may be considered natural in which the woman might be delivered safely without help.

What conditions should exist that natural labor may take place? There should be regular contractions of the uterus, a favorable presentation, the pelvis of a proper size, a proportionate head, and the soft parts relaxed.

What are considered to be the *natural presentations?* There are four: 1st, of the *head*—2d, of the *feet*—3d, of the *knees*—and 4th, of the *breech.*—*Dewees.*

Of these, which is the most frequent and the most favorable? The presentations of the *head.*

How are the presentations of the head *divided?* There are six.

What are their positions, and how are they distinguished? The *first,* which is known by the posterior fontanelle being behind the left acetabulum, and the anterior before the right sacro-iliac symphysis.

The *second,* distinguished by the posterior fontanelle being behind the right acetabulum, and the anterior before the left sacro-iliac symphysis.

The *third,* distinguished by the posterior fontanelle being behind the symphysis pubis, and the anterior before the projection of the sacrum.

The *fourth,* distinguished by the anterior fontanelle being behind the left acetabulum, and the posterior before the right sacro-iliac symphysis.

The *fifth,* distinguished by the anterior fontanelle being behind the right acetabulum, and the posterior before the right sacro-iliac symphysis.

And the *sixth* is the reverse of the third.

To remember these presentations easily, notice that the 1st, 2d, and 3d presentations are represented by the posterior fontanelle; and the 4th, 5th, and 6th, by the anterior fontanelle; and that we

constantly follow their numerical order, commencing with the left acetabulum, then with the right, and then go to the symphysis pubis; each fontanelle following the same route and order.

What are the *distinguishing marks* of the presentation of the head? Its roundness, firmness, sutures, and fontanelles.

The particular position of the head relatively to the pelvis is determined by the situation of the sutures and fontanelles.

Mechanism of Labor.

What is the *mechanism* of the *first presentation?* The head enters the superior strait obliquely, in the position described in the first presentation.

The head is *flexed*, with the chin on the breast, and descends in this position, with its axis corresponding with the axis of the superior strait. (Fig. 14.) When it arrives at the sacro-sciatic

Fig. 14.

ligaments, *rotation* is performed by the head of 1–6 of a circle, while the body remains in the same position; the centre of the occipital bone will then be found to correspond with the symphysis

pubis, and the sagittal suture with the antero-posterior diameter of the pelvis. As the head advances, the chin departs from the breast, the vertex advances, separates the external parts, rises up towards the mons veneris, and describes about a quarter of a circle backwards; this motion is called *extension*, and may be considered perfect, just as the face is clearing the perineum. (Fig. 15.)

Fig. 15.

As soon as the head has escaped externally, it takes a position at right angles with the shoulders, or its natural position in relation to them; this is called *restitution*. (Fig. 16.) In these motions, it will be seen that the small diameters of the head correspond with the small diameters of the pelvis; and that it executes five motions, that of *flexion*, *descent*, *rotation*, *extension*, and *restitution*.

Which shoulder presents at the symphysis pubis in this presentation? The right shoulder.

What is the *mechanism* of the *second presentation?* It is the same as the first, if we place the head in the position of the second presentation at the superior strait; and the left shoulder passes out under the arch of the pubes.

What is the *mechanism* of the *third presentation?* In the

Fig. 16.

third position, the head is presented at the superior strait with its longitudinal diameter, corresponding with the antero-posterior diameter of the pelvis; it *descends* in this manner, and performs the motions of *flexion* and *extension*, but not those of rotation and restitution.

Which shoulder presents to the symphysis in this presentation? There is no certainty whether it will be the right or left.

What is the *mechanism* of the *fourth position*? The head presenting with the anterior fontanelle at the left acetabulum descends until a portion of the right parietal bone rests upon the inferior part of the sacrum, when rotation takes place, and the forehead is placed under the arch of the pubes; the anterior fontanelle will be found in the middle of the arch; the posterior above the point of the sacrum; the occiput continues to advance over the coccyx and perineum until it is cleared from it; the occiput then turns backwards towards the anus of the mother, and the face disengages itself from under the pubes. In this and the fifth, the forehead often rotates into the hollow of the sacrum: in fact, it is now well established that this is the most frequent mode of termination of the fourth and fifth positions of the head, and, also that it is the most favorable.

Which shoulder presents to the arch of the pubes? The left.

To what position may this be changed with advantage? To the second; and the fifth may be reduced to the first.

How is this *accomplished?* The uterus must be well dilated, the membranes ruptured, the head occupying the lower strait, and the labor active. The point of the forefinger must be placed against the edge of the sagittal suture, before or behind the anterior fontanelle; in the absence of pain, press the part towards the left sacro-iliac symphysis, maintain it there during the next pain, and this must be repeated again and again until we succeed. This is the direction given by Dewees, but from closer observation in reference to the mechanism of the third and fourth positions, it is ascertained that the desired change is usually effected by nature, without any artificial interference.

What is the *mechanism* of the *fifth presentation?* The relations of the child's head to the pelvis are the same as in the fourth, only the anterior fontanelle at the superior strait is placed at the right acetabulum; and the right shoulder presents at the arch of the pubes.

What is the *mechanism* of the *sixth presentation?* This presentation is the reverse of the third; and in addition to the great diameter of the head being parallel with the small diameter of the upper strait, the forehead has to come under the arch of the pubes; so that the first part of the labor resembles cases of the third presentation, and the latter part resembles cases of the fourth and fifth when the occiput does not rotate forwards.

Presentation of the Breech.

What is the order of frequency of the natural presentations? The breech is next in frequency to the head; then the feet and knees.

What is the *principal danger* in these cases where the body of the child is first delivered? It arises from delay in delivery of the head, and compression of the umbilical cord; consequently, breech presentations, from the perfect manner in which the external parts are dilated, preparatory to the passage of the head, are less dangerous than the feet and knee presentations, although it may be a little more tedious to the mother

What are the *symptoms* of a breech presentation? It may be known by the soft tumor wanting the characteristics of the head; having neither its sutures, hardness, nor roughness. A deep groove is observed leading to the anus and parts of generation, and after the rupture of the membranes a discharge of meconium will corroborate, but not positively confirm, the diagnosis.

What are the *varieties* of breech presentations? There are four. In the *first*, the lower part of the spine and sacrum offer to the left acetabulum, and the abdomen looks towards the right sacro-iliac symphysis. (Fig. 17.) The following figures represent the first presentation of the breech in its various turns through the pelvis, or its mechanism.

Fig. 17.

Fig. 18.

In the *second*, the back of the child answers to the right acetabulum, and the belly to the left sacro-iliac junction. (Fig. 18.)

Fig. 19.

In the *third*, the spine is behind the symphysis pubis, and the belly towards the projection of the sacrum. (Fig. 19.)

The *fourth* is the reverse of this last.

What is the *proper management* of cases of breech presentation? It is not to interfere, unless complicated with some circumstances which may render it necessary.

Presentation of the Feet.

What are the *characteristics* of feet presentations? They are easily told by the projecting heels, the short toes, and from the hands, to which alone they bear any analogy by the absence of the thumb.

What are the presentation of the feet? There are *four.* In the *first,* the heels are anterior to the left acetabulum, and the toes are directed towards the right sacro-iliac symphysis. In all these cases, the legs are flexed upon the thighs, and the thighs on the pelvis.

In the *second,* the heels are behind the right acetabulum, and the toes look towards the left sacro-iliac symphysis; in all these cases, the other parts of the body correspond to the position of the feet.

In the *third,* the heels are at the symphysis pubis, and the toes to the sacrum.

In the *fourth,* the position is reversed; the heels are to the sacrum, and the toes to the pubes.

Presentation of the Knees.

What are the presentations of the knees? There are *four.* In the *first,* the legs are to the left side of the mother, and the thighs to the right.

In the *second,* the legs are to the right, and the thighs to the left.

In the *third,* the legs are under the arch of the pubes, and the thighs towards the sacrum.

The *fourth* is the reverse of the third.

OF LABORS IN WHICH THE PRESENTATION IS NATURAL, BUT RENDERED DIFFICULT OR PRETERNATURAL.

What are the causes which may render a natural labor *preternatural?* They are, 1st, *flooding:* 2d, *convulsions:* 3d, *syncope:* 4th, *hernia:* 5th, *obliquity of the uterus:* 6th, *partial contractions of the uterus:* 7th, *compound pregnancy:* 8th, *descent of the eord:* 9th, *too short a cord:* 10th, *bad position of the head:* 11th, *exhaustion:* 12th, *hemorrhages from the lungs or other organs.*

Flooding as a complication of Natural Labor.

Under what *conditions* of the os uteri may hemorrhage take place during labor? It may be either partially dilated and rigid; or it may be dilated, or easily dilatable.

What should be the *treatment* when the os uteri is rigid? There should be no hasty or rash interference, and it would be the height of imprudence to enter the uterus and attempt turning. The discharge should be controlled by rest, a horizontal posture, by bloodletting if indicated, large doses of acetate of lead, cold applications, and the tampon. In some cases, when the above means fail, benefit may be derived from promoting the contractions of the uterus by rupturing the membranes.

What should be the *treatment* when the os uteri is dilated or dilatable? We should at once proceed to turning, unless rupturing the membranes should abate the discharge, or the activity of the labor promise a speedy delivery. If the labor is far advanced, the forceps may be necessary.

Convulsions.

What *course* should be pursued in convulsions as regards delivery? If the os uteri is rigid, delivery should not be attempted; bloodletting, cathartics, and such other means as may be called for, should be resorted to, until the uterus becomes relaxed, when we may proceed to turn, unless the natural powers of the uterus are sufficient to accomplish a delivery.

When the uterus is dilated or easily dilatable, we should at once proceed to turning, after a copious bloodletting. In cases where the waters have been long drained off, and the head low in the pelvis, we should use the forceps.

Syncope.

What *course* should be pursued in cases complicated with syncope? The *cause* should at once be sought out; and if it depends upon a peculiarity of the nervous system, little need be done. But, if it proceed from internal or concealed hemorrhage, we should deliver immediately, unless the state of the os uteri prevent.

Hernia.

When a hernia is in danger of becoming strangulated, what *course* should be adopted? Turning, if the os uteri is in a proper condition.

Bad position of the Head.

What may be considered bad positions of the head, particularly when the head is relatively large, or the pelvis relatively small? When the head presents at the superior strait, as in the third and sixth presentations.

When the chin departs from the breast too early.

When the face presents from excessive departure of the chin from the breast.

And when some part, as the hand or arm, accompanies the head.

What is the remedy for the *first* of these difficulties? The head shall be grasped so that the thumb may lie on one side, and the fingers on the other; it shall then be raised, and in the third presentation the vertex shall be turned towards one of the acetabula; if the right hand be used, turn it towards the right acetabulum, and if the left towards the left acetabulum; then trust to nature. The sixth presentation should be changed either to the fourth or the fifth, which will be as much rotation as the neck will bear.

What is the remedy for *too early departure of the chin from the breast?* It is to restore it by pushing up the forehead in the absence of pain, and retain it there with the points of two or three fingers until a pain comes on, and the vertex is found to descend; it may then be trusted to nature.

What are the varieties of *face* presentations? There are four: in the 1st, the forehead offers to the left, and the chin to the right side of the pelvis; the 2d is the reverse of this; in the 3d, the forehead answers to the symphysis of the pubes, and the chin to the sacrum; the 4th is the reverse of this. The following figures represent the positions of the head in the pelvis, where the face presents in the first position, or the mechanism of that position. (Figs. 20, 21, 22.)

How may face presentations be *distinguished?* By the presence of the eyes, nose, mouth, and chin.

At what period, and how may they be *remedied?* When the uterus is dilated or dilatable, and the head has not passed the superior strait; with the waters recently expended. Pass the hand which is on the side on which the vertex and forehead are placed; in the first and second presentations, put the back of the fingers to the posterior part of the pelvis, and place them on the side of the head, while the thumb is placed against the opposite side; the head is then to be raised, the fingers carried over the vertex, and the thumb to the forehead; while the fingers are made to draw the vertex downwards, the thumb is to press the forehead upwards. This is to be done in the absence of pain, and retained until a pain comes on, and the head takes the proper direction.

Fig. 20.

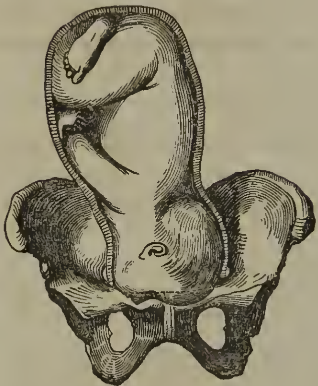


Fig. 21.

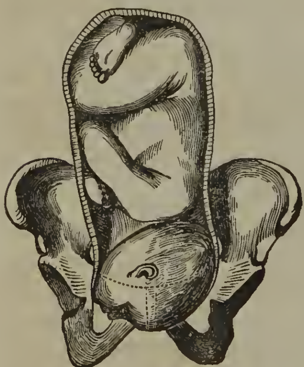


Fig. 22.

Nature is generally adequate to the safe delivery of face cases. They should not, therefore, as a general rule, be interfered with, unless the progress of the case becomes complicated, and inter-

ference is necessary for the safety of the woman or child. These cases are ranked under the head of natural labor by many authors.

What is the proper remedy when the *hand* presents with the head? It should be prevented from descending by placing the point of the forefinger between the fingers of the child, and supporting it during a pain, at the same time directing it towards the face; as the head descends, the hand may in this way be made to retire within the cavity of the uterus.

What is the remedy in the other cases of complication of a natural labor requiring interference? *Turning*, when the condition of the os uteri will admit of it; but in no case is the uterus to be entered, unless the os uteri is either dilated or easily dilatable. The forceps should be used when the head is low in the pelvis.

What is the proper *position* of a woman for turning? The back is the best; with the lower extremities over the edge of the bed, and the feet resting on chairs, so as to leave the perineum and coccyx free.

What *time* should be chosen for the introduction of the hand, and how should it be done? It should be formed into a cone, with the thumb looking towards the symphysis pubis, and introduced into the vagina during a pain, and into the uterus during its absence.

Is it proper to turn a child after it has passed the os uteri? No; it should be done as soon as possible after the first stage of labor is completed.

When the hand is in the uterus, to what part should it be passed? The hand should grasp the head with the fingers on one side, and the thumb on the other; raise it in the axis of the superior strait, and place it in the iliac fossa towards which the palm of the hand looks; where it must be retained by the wrist and forearm, while the fingers trace the side of the child to the feet, which should be grasped firmly, and both acted upon at the same time when practicable. (Fig. 23.)

In what direction should the feet be conducted when bringing them down? So that the toes should always look towards the abdomen of the child. (Fig. 22.)

Is it proper to attempt to turn a child during a pain? No; the uterus might be lacerated.

Is it proper to complete the delivery in cases of turning, or

Fig. 23.

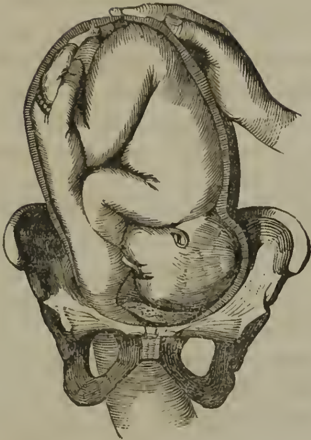
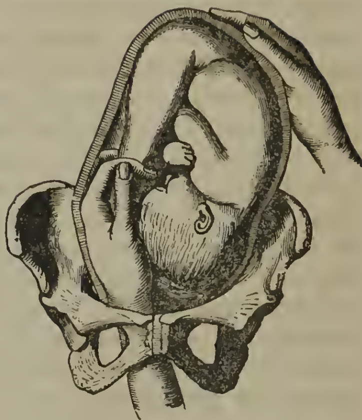


Fig. 24.



bring down the feet and permit the natural powers to finish? When commenced, it should be completed slowly and steadily.

When the feet are brought through the external parts, what

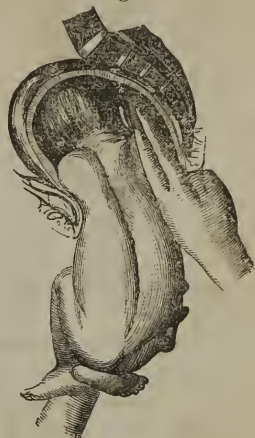
Fig. 25.

Fig. 26.

should be their position? The toes should look towards the anus of the mother; and when it is delivered beyond the umbilicus, it should be made to pass through the arch of the pubes with its spine looking towards, or pressing against either the right or left leg of the pubes, that the head may enter the superior strait obliquely. (Figs. 25, 26.)

When the axillæ appear at the os externum, what should be done? The one next the sacrum should be first delivered, by passing a finger or two upon the point of the shoulder, and pressing it downwards, tracing the arm to the elbow, which may be pressed upon downwards and forwards towards the face of the child, where it will almost always be disengaged. To deliver the second arm, turn the shoulder of that arm to that side of the pelvis to which the face of the child looks; and it will instantly become disengaged from the head, at the small diameter of the superior strait, and may be brought down in the same manner as the first. (Fig. 27.)

Fig. 27.



When the child is all delivered except the head, what should then be attended to? The position should first be ascertained; and if it does not already exist, a proper relation should be established between the diameters of the pelvis and the head of the child; a little force should now be applied in the direction of the axis of the superior strait. When in the inferior strait, the proper relation should again be established between the diameters of the head and this part of the pelvis. (Fig. 28.)

The mother should now be directed to assist by her voluntary powers, and the child may be acted upon in the direction of the axis of the inferior strait, while we press against the occiput in such manner as will tend to disengage it from behind the pubes; and a very slight traction may be made on the lower jaw; this, however, should be done with great care. (Fig. 29.)

What are the *dangers* arising from deliveries of this kind? *Compression* of the *cord*, *compression* of the *head* and *chest*, and

Fig. 28.

Fig. 29.

extension of the *neck*. To obviate the last difficulty, we should co-operate with the pains of the mother when they exist, and the whole should be conducted coolly and deliberately.

Which hand should be employed in cases of turning? Always use that hand which will look towards the face of the child. In the first presentation, it will be the *left* hand; in the second, the *right;* and for the third and sixth either hand will be proper, or the one of which we have the greatest command.

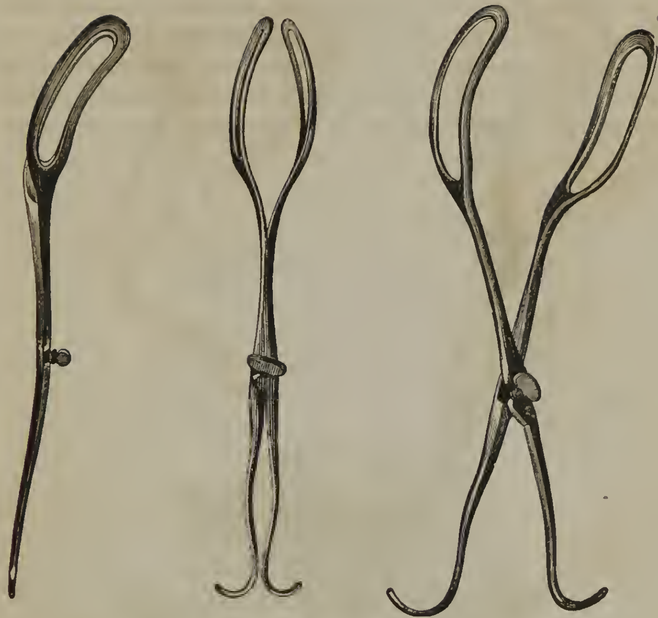
Of the Forceps.

What kind of forceps are generally used? There are two; the *short*, and the *long*.

The *short* are preferred when the head is very low in the pelvis, and the *long* when high up. The long forceps are, however, better adapted to both conditions, and should, on the whole, be preferred. The "eclectic forceps" of Professor Hodge are to be preferred, on many accounts, to any others. (Fig. 30.)

What do the forceps *resemble*, and when are they *indicated?* They may be compared to a pair of artificial hands, and are indi-

Fig. 30.



cated when the powers of the uterus cannot accomplish delivery, when the case is complicated requiring immediate delivery, and the head passed the os uteri. They are, however, sometimes applied at the commencement of the second stage of labor, but it should only be attempted when turning is impracticable, and by a person well skilled in their use.

What is the best *position* of the woman for the application of the forceps? The one recommended for turning.

Should the condition of the bladder and rectum be attended to? They should both be emptied before the forceps are used; the external parts and the instruments should also be coated with hog's lard.

What should be the condition of the os uteri, and membranes? The os uteri and external parts should be relaxed, and the membranes ruptured.

What is the mode of procedure in the first presentation, and the head low in the pelvis?

One or two fingers of the right hand should be introduced carefully into the vagina, so as to separate the soft parts from the fœtal head on the left side of the mother; the male blade should then be seized by the left hand, as we hold a pen, held obliquely over the right groin, and its blade introduced along the finger

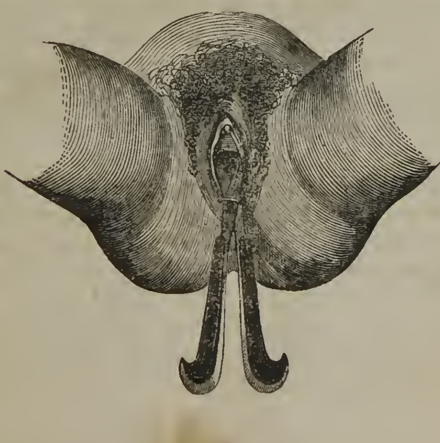
Fig. 31.

towards the left sacro-iliac symphysis. As the blade passes up, its handle will of course be depressed and gradually brought towards the median line of the body, until it lies back against the perineum, and there retained in that position by an assistant. (Fig. 31.) The introduction of the female branch should then be accomplished in a similar manner, only the position of the hands is reversed, the left being introduced into the vagina, and the right holding the female blade of the forceps. (Fig. 32.)

Fig. 32.

The position of the forceps, when applied, will be represented by the two following figures. (Figs. 33 and 34.)

Fig. 33.



To what parts of the head should the blades of the forceps be applied? To the sides of the head over the ears of the child in the direction of its oblique diameter; and so that their concave edges will come under the arch of the pubes at the last period of labor.

Fig. 34.

In cases of difficulty in causing the handles of the instrument to join, should they be brought together by force? No; the cause of their not locking must be ascertained, and remedied; force should never be used.

What are the *modes of action* of the forceps? They have two modes of action; that of *compression* and that of *traction* and *compression*.

May the life of the child be destroyed by compression from the use of the forceps? It may; care should be taken in this respect, and, after each tractive effort, the forceps should be permitted to expand themselves.

In what manner should traction be made? It should be made from blade to blade, so that each may act as a lever upon the head.

The *extent* of this motion of the handles must be governed by the distance of the head from the external parts; the less the head is advanced, the more circumscribed should be the motion, and the reverse. The general direction of this traction should correspond with the axis of that part of the pelvis through which the child is passing.

Should a labor be completed by the forceps in all cases where their application is necessary? They may be removed when the head has nearly passed through the external parts, provided the pains continue, but not otherwise.

Of Locked or Impacted Head.

What are the *varieties* of locked head? There are *two*:—

1st. Where the head is jammed with its greatest length between the pubes and sacrum.

2d. Where its thickness cannot pass, owing to the narrowness of the pelvis.

In the *first* place, the points of pressure are the forehead and occiput; and in the *second*, it is the parietal protuberances.

What are the *causes?* Long continued and vehement action of the uterus, and a disproportion between the diameters of the pelvis and head; either from malposition of the head, its size and solidity, or from deformity of the pelvis.

What are the attending *symptoms* of a locked head? Immobility, accompanied by swelling of the hairy scalp of the child, thickening of the os uteri, a swelling of the vagina and external parts.

What are the *dangers?* The mother is exposed to inflammation, sloughing, and gangrene, and the child to almost certain death.

What are the *indications?* The delivery of the child; which should be effected by the forceps if the child is living, and if dead the crotchet may be employed.

Uterine Hemorrhage.

How is uterine hemorrhage *divided?* Into the *accidental* and the *unavoidable.*

What is meant by *accidental hemorrhage?* It is that which occurs at any period of pregnancy from a detachment of the placenta, when situated at the body or fundus of the uterus.

What is meant by *unavoidable hemorrhage?* It is that which occurs from the situation of the placenta over the mouth of the uterus.

Accidental Hemorrhage.

At what *period* of pregnancy may accidental hemorrhage take place? At any time after the first month.

What is the period of the greatest *danger?* As a general rule, it is in proportion to the advancement of pregnancy.

What is the division of accidental hemorrhage for practical purposes? There are *four* divisions: —

1st. Hemorrhage which occurs at the period when the ovum is entirely surrounded by the decidua and decidua reflexa.

2d. That which occurs during the remaining period of utero-gestation.

3d. That which occurs between the birth of the child and the expulsion of the placenta.

4th. That which occurs subsequent to the expulsion of the placenta.

What are the attachments of the ovum during the first period? It is attached to the parietes of the uterus at all points of its surface; and when separated entire resembles an ovular, spongy, fleshy mass. Hemorrhage may occur, therefore, from its separation at any part.

What is the condition of the neck of the uterus *indicating* abortion? When it becomes distended so as to resemble in feel the extremity of an egg, abortion will take place almost certainly.

The cessation of morning sickness, a diminution of the abdominal tumor, the painful distension of the mammæ with milk, followed by flaccid breasts, also almost certainly indicate that abortion will take place. Neither pain nor flooding is a positive symptom that abortion will follow.

What are the *indications* in the *treatment* during this period? To arrest the bleeding, subdue pain if present, and prevent a recurrence of the hemorrhage.

By what *means* may these be accomplished? By perfect rest of body and mind; the bed should be a mattress, or sacking bottom. Feather beds should be avoided. The room should be ventilated, the patient thinly covered, the drinks cold, and everything of a stimulating nature entirely prohibited, either for food or drink.

Bloodletting may be used or not, according as it may or may not be indicated by the force of the arterial system.

Acetate of lead should be given in doses of two or three grains guarded with opium every two hours, or twenty or thirty grains with a drachm of laudanum dissolved in a gill of water; or starch may be used as an enema, and repeated if indicated.

If pain exist, opium should be given so as to create a decided impression upon the uterus, or else it proves itself unavailing.

Ice-water may be applied to the pubes when the discharge is profuse, but our greatest reliance should be on the tampon.

In all cases where the hemorrhage is alarming, whether there is a certainty that abortion will take place or not, we should use the proper means for arresting it, and the tampon will almost certainly do it.

At what period may the ovum be pierced for the purpose of arresting hemorrhage? Never before the fifth month; and, when it is ruptured before this period, the treatment of the case is more tedious from the retention of the placenta.

When the ovum or placenta is partially expelled, and hemorrhage is kept up by their presence, what course should be adopted? It should be removed by the finger, Dewees' hook, or by forceps or scoop invented for this purpose.

Sometimes ergot will act efficiently in removing them, and may be given with propriety.

What are the indications in the treatment during the second period? They are the same as for the first.

The same rules and treatment should be put in practice at once, and the tampon used early if necessary.

Suppose these means fail, what should be done? We should rupture the membranes, and proceed to deliver if necessary, provided the os uteri is in a proper condition; when it is not, we should rely upon the tampon until it becomes so. Rupturing the membranes will, in the majority of cases, be sufficient to arrest the discharge.

In what other condition would it be improper to effect delivery? When the woman is reduced to the last extremities of weakness, and the discharge suspended; but if it continue, it is the only chance remaining.

What are the limits of the beneficial application of cold? When it has controlled arterial action, and perhaps produced some contractions of the uterus; these being accomplished, little benefit can be derived from its continuance.

What are the modes of delivery to be resorted to? Turning, and the use of the forceps under the restrictions heretofore mentioned.

Can hemorrhage take place at any time without a separation of a part or the whole of the placenta? It cannot.

What are the *immediate causes* of hemorrhage *after delivery?* A separation of the placenta, and atony or imperfect tonic contractions of the uterus.

What are the *varieties?* It may be *external*, or *internal* and *concealed.*

What are the *symptoms* of concealed hemorrhage?

There is a flaccid condition of the uterus, except of the neck, which is contracted; it becomes enlarged, and may even equal the size which it had before labor; the effects of the loss of blood are also soon exhibited, unless the hemorrhage is checked.

What are the *means* used for hemorrhage after delivery? The contraction of the uterus should be excited, and continued. Friction with the tips of the fingers over the fundus will generally produce it, but if it swell we should grasp it with a sudden but moderate force. The hand should be introduced into the uterus if this does not at once arrest it, and the placenta delivered; a dose of ergot should then be given, which will insure its contractions afterwards.

The excitement of this process will also have a tendency to produce a permanent contraction. The sudden application of cold, frequently repeated, also has a beneficial effect in this way, applied either by wet cloths, by a douche on the abdomen, or as an injection into the uterus. Firm, steady pressure over the uterus, but above all the application of the child to the breast, will almost always bring about permanent tonic contraction; upon which alone the safety of the woman depends. The introduction of the hand into the uterus for the purpose of exciting its contractions, and extracting the coagula, is also recommended after the placenta is expelled, if necessary.

What means may be adopted before delivery to prevent hemorrhage in women subject to it? By evacuating the waters, and diminishing the force of the circulation, by making the woman preserve a horizontal position, by the interdiction of stimuli of every kind, and the exhibition of ergot just before the labor is completed.

What are the *symptoms* of *encysted placenta* from *hour-glass contraction?* It may be known by the fundus of the uterus reaching higher than common, by being smaller in its transverse diameter; by an elastic feel of the cord; by the absence of severe pain, by the placenta not being within reach of the finger; when the

hand is introduced, the cord is found to pass through a small aperture, and the placenta is felt lying within the cavity formed by this contraction.

What is the *treatment?* As soon as discovered, the woman should be placed in the position for turning, the hand introduced into the vagina, and then passed along the cord until an entrance is gradually effected through the stricture; the mass should then be separated if adherent, and brought away by a gentle, cautious motion of the hand. The exhibition of chloroform will greatly facilitate this process.

Unavoidable Hemorrhage.

At what *period* of utero-gestation may unavoidable hemorrhage occur? It generally occurs first between the sixth and seventh month, and gives us the first knowledge of the situation of the placenta over the mouth of the uterus.

Why does it not occur *earlier?* Because the neck of the uterus is not unfolded much before this period; therefore the placenta is not disturbed, or separated. It does not necessarily follow at this time, or before labor commences; but the patient is unavoidably liable from the mechanism of the expansion of the neck of the uterus.

What are the *symptoms* of unavoidable hemorrhage? When the full time arrives, hemorrhage comes on suddenly, and often alarmingly, without pain; or, if attended with pain, it is increased at every pain. This should lead us to suspect a placental presentation or *placenta prœvia.* The hand should be passed into the vagina, and the finger into the os uteri, where the placenta may be distinguished by its firmness and fibrous structure from a coagulum; to which alone it bears any resemblance. If a case of placental presentation be left to nature, in what ways may it terminate? In one of two modes: the pains may occur with great rapidity, and delivery be successfully accomplished; but death is nearly always the result from excessive hemorrhage; this last result would be the usual one — therefore, the rule is to interfere in all cases.

What is the *treatment?* In slight cases, at the early periods of pregnancy, the ordinary treatment of hemorrhage may be sufficient; but when profuse, and having ascertained it to be a placental presentation, the condition of the mouth of the uterus should

be ascertained. If it is rigid, we should use those temporizing means adapted to the case, among which the tampon stands first; and if it is dilated or dilatable, recourse should be had to *turning*, subject to the rules formerly mentioned. The membranes should be preserved entire; the hand should be insinuated between the os uteri and placenta, at the part where the separation has taken place; then passed up between the uterus and membranes before rupturing them. They may then be ruptured, the feet seized, and the child delivered; this operation should, however, be performed with the greatest care. Another method of procedure has been recommended by Drs. Simpson, of Edinburgh, and Radford, of Manchester, which is to *detach* and *extract* the whole placenta before the child. The grounds for this recommendation are: 1st. That the entire detachment and removal of the placenta before delivery of the child, are not usually followed by any great hemorrhage. 2d. That any that may have previously existed nearly always ceases as soon as the placenta is *perfectly* and entirely detached from the uterus. 3d. That the discontinuance of the hemorrhage is explicable on the mutual vascular arrangement of the uterus and placenta, and that the bleeding principally occurs from the partially detached surface of the latter, and not from the uterus; therefore, the cessation does not depend upon the pressure of the child's head upon the uterine vessels.

This procedure is not, however, recommended by them in all cases, and only, 1st. When the patient is of very delicate and weakly constitution, and not able to bear the loss of blood. 2d. When the child is dead. 3d. In cases of exhaustion from hemorrhage, and the os firm and unyielding. 4th. In cases of extreme exhaustion, although the os may be dilatable, but the powers of life unequal to the shock of turning. 5th. In prima-paræ, when the soft parts are so contracted that they would be liable to be bruised or torn in turning. 6th. In contracted pelves.

This practice is condemned by many eminent men, who recommend turning, even if the placenta be detached, so as to terminate the labor. If this course is adopted, and turning is not resorted to, a dose of ergot may be proper for the purpose of hastening delivery.

Of Puerperal Convulsions.

At what *period* of utero-gestation may a woman be attacked with puerperal convulsions? At any period, but more particularly after the sixth month.

How are puerperal convulsions *divided?* They are divided into the *epileptic*, the *apopletic*, and the *hysterical.*

Do convulsions take place suddenly, or are they preceded by premonitory symptoms? They are generally preceded by *premonitory symptoms.*

What are the *premonitory* symptoms? In the epileptic and apoplectic species, they are a strong determination of blood to the head, producing headache, ringing in the ears, temporary loss of vision, giddiness, &c.

What is the proper *treatment* for this stage? Bloodletting, brisk purging, and low diet; which will generally prevent an attack. The longer the premonitory symptoms exist, the milder will be the attack; the cases which are attacked very suddenly are generally fatal.

What are the *symptoms* of the *epileptic* variety? After a longer or shorter continuance of the premonitory symptoms, the woman may be seized with quickly repeated spasms, violent agitation of the face, eyes, and the whole body. The face becomes flushed, livid, black, and the tongue is thrust between the teeth. The respiration is disturbed or suspended, the carotids beat violently, and froth issues from the mouth. The pulse in the beginning is full, frequent, and tense, but becomes rapid, small, and imperceptible; a cold, clammy sweat appears, and the fit begins to decline. When the spasm goes off, the patient sometimes remains comatose and insensible, with stertorous breathing.

These paroxysms may follow each other in quick succession.

There is also a variety of epileptic convulsions which are called *anæmic;* proceeding from a very different condition of the system, and may be distinguished from the above by the pale face, glazy eye, shrunken features, colorless lip, cold moist skin, and other symptoms indicating a collapsed condition of the system.

The *treatment* in these cases should of course be of a directly opposite kind.

What are the *symptoms* of the *apoplectic* variety? The pre-

monitory symptoms are of shorter duration than the epileptic, and those following are more violent. It may be considered as an exalted degree of the epileptic.

What are the *symptoms* of the *hysterical* variety? We have not the same premonitory symptoms as we have in the epileptic; but we may have ringing in the ears, palpitation of the heart, *globus hystericus*, &c. The convulsions are not so violent, the face is less flushed, and the muscles on the posterior part of the body are generally violently contracted. This last circumstance is considered by Dr. Dewees as strongly characteristic of this variety of convulsions. It also attacks women of delicate and nervous habits.

What is the proper *treatment* in the epileptic and apoplectic varieties? Bleeding should at once be had recourse to from a large orifice, and repeated as circumstances may indicate. Cathartics and purgative enemata should be given, cold applied to the head, and blisters or sinapisms to the extremities. After the adoption of the above means, so far as they may be indicated, Prof. Chapman places great reliance in the prompt exhibition of opium, sufficiedt to produce sleep. Whenever the os uteri is in a proper condition, we may finish the labor, if it have commenced, by turning, or the forceps; our choice depending upon the stage of labor, and the circumstances regulating the application of each.

What is the *treatment* for the hysterical variety? A moderate bleeding in most instances, followed by tincture of assafœtida and laudanum, cold dash, &c.

Of Inversion of the Uterus.

What is meant by Inversion of the Uterus? It is where the fundus is forced down into the cavity of the uterus, and through the os uteri into the vagina, or where the whole uterus is turned inside outwards, and the fundus appearing at the os externum. The former is termed partial, and the latter complete inversion.

Under what *circumstances* may inversion of the uterus take place? In certain cases of polypus and immediately after delivery.

What are the *causes?* Any force applied to the fundus, whether by the cord, or externally, immediately after having been emptied suddenly, violent straining, attempts at coughing, sneezing, or by any sudden action of the abdominal muscles.

How may an inversion be *distinguished?* In the partial, it may be known by the absence of the hard, spherical tumor of the fundus above the pubes, and by the presence of a globular, fleshy body in the os uteri, which is sensible to the touch.

The patient complains of a dragging sensation in the groins and lumbar region, compelling her to strain violently; there is hemorrhage, an oppressive sense of sinking, with nausea, or vomiting, cold sweats, faintings, and often convulsions.

In the complete, hemorrhage and violent pain are absent; although death may suddenly follow from the shock received by the nervous system, or from fainting.

What is the *treatment?* It should be returned immediately, and the difficulty of doing this will be in proportion to the time elapsed from the accident. When the placenta is adherent, there is a difference of opinion whether we should remove it, or return it with the uterus, and allow it to be thrown off afterwards by the contractions of this organ. In cases of complete inversion, the better practice is to separate it, as there is comparatively little danger from hemorrhage.

In the partial, perhaps, it would be better to attempt to replace the uterus with the placenta; but, if it offer much resistance and delay to the reduction, it should be at once removed.

What is the manner of *reduction?* The tumor should be firmly grasped, and pushed up bodily in the direction of the axis of the os uteri; and we should endeavor first to return that portion of the uterus which was expelled last from the os uteri When it has ascended so high that we are no longer able to grasp the tumor, we should spread the fingers at equal distances round it, and thus apply the pressure over a large space; the direction of this pressure will vary with the axis of the pelvis; when the fundus passes the os uteri, it usually recedes suddenly. If we find the uterus contracted above the pubes, the hand may be withdrawn; but if it is flaccid and soft, the hand should be introduced into the uterus so as to excite active contractions, and prevent a return of the fundus. The patient should then be kept quiet, and not allowed to make any sudden exertion. When the uterus is partially inverted, and cannot be replaced, it is preferable that we should make the inversion complete, as recommended by Dr. Dewees. In

some cases of these chronic inversions, the uterus has been removed by ligature.

Of Twins.

What is the average proportion of Twins in this country? About one in seventy-five.

How are twins situated in regard to each other? They may be enclosed in one common covering of membranes, and float in the same waters. In other instances, they may each have a separate amnion, while the chorion may be common to both; or each may have its own membranes, waters, and placenta.—*Dewees*.

How may a case of twins be known after the birth of the first child? The abdominal tumor does not subside as it does in a case of a single child. The child may be felt through the abdominal and uterine parietes; there is generally a renewal of the pains, and the child can be felt per vaginam.

After the birth of the first child, and it is ascertained that there is a second, what is to be done? In the first place, two ligatures should be applied to the cord; then divide it between them. Pain will either come on and deliver the child, (in which case we should conduct the case as though it was an original labor,) or there will be a suspension of pain.

How are we to proceed when there is a suspension of pain? In this case, the uterus will be either contracted or uncontracted. If in the first condition there may be hemorrhage, we should treat it as any other case of hemorrhage, and deliver if necessary; or hemorrhage may be absent, in which case friction should be made until it contracts.

If contracted, and pains do not pretty soon follow, say in half an hour, it will be better to proceed to delivery; but in no case where hemorrhage is absent, without this tonic contraction being secured. After delivery, hemorrhage should be carefully guarded against.

Of the Presentation of the Arm and Shoulder.

What are the presentations of the Arm and Shoulder? They may present in four different ways at the superior strait.

The position of the shoulder may be difficult to distinguish,

unless the arm is also down; in which case, it will serve to indicate the position of the shoulder.

In the *first* position, the head and side of the neck of the child are to the left side of the pelvis; and the right arm down, with the back of the hand anterior, and the palm posterior.

In the *second*, the head and side of the neck will be to the left side of the pelvis, the palm of the hand will look outwards, and the back to the posterior part of the pelvis.

In the *third*, the head and side of the neck will be to the right side of the pelvis; the left arm down, with its back looking outwards, and the palm inwards.

In the *fourth*, the right arm will be down, with the palm looking outwards, and the back inwards.

These positions are sometimes distinguished as *first* and *second* for the *right* shoulder, corresponding with our *first* and *fourth;* and *first* and *second* of the *left* shoulder, corresponding with our *second* and *third*. In the first of *each*, the head is on the left side of the pelvis, and in the second of *each* it is on the right. The preceding figures refer to this division, and may easily be understood by the above explanation.

Fig. 35.

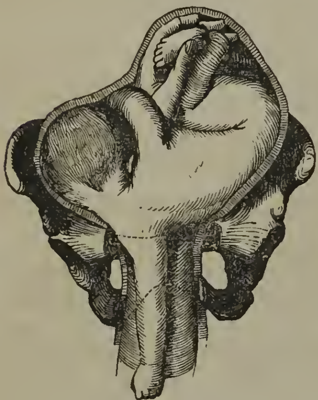
Fig. 36.

When *turning* is resorted to, which hand should be used in these presentations? In the *first* and *fourth*, the *right* hand may be used; and in the *second* and *third*, the *left*. There is a difference

in the directions of authors as to the proper hand to use, and it is advised by some to use that hand of which we have the greatest command, whether it be the right or left. (Figs. 35, 36, 37.)

What use should be made of the arm in shoulder presentations? It offers no indications except that it points out the situation of the shoulder. There can be no manœuvre performed upon it to advantage, so that traction, amputation, &c., should be entirely avoided.

Fig. 37.



Suppose a shoulder presentation be left to the unassisted efforts of nature, what will be the result? The efforts of the uterus will rupture its own structure, which would be fatal; exhaustion and death will occur by continued effort; or the child will pass double, or by the "*spontaneous evolution.*"

What are the *indications* in these presentations? They are to bring down the feet, and deliver.

There are, however, four modes pursued in these cases: One is to turn, and bring down the breech to the brim of the pelvis, or the feet into the vagina. Raise the shoulders, and bring down the head, or cephalic version. Wait for spontaneous evolution. Use cutting instruments to the child.

Turning and *bringing down the breech* or *feet* is the safest for the mother, and this proceeding is the one most likely to succeed; although the chances of saving the child are less than in cephalic version when it can be accomplished.

Bringing down the head, or *cephalic version*, is safer for the child, but more dangerous for the mother, on account of the difficulty in accomplishing it.

Spontaneous evolution sometimes takes place, but cannot be relied upon in practice.

The *use of cutting instruments* is only to be resorted to when turning is impossible.

In what does spontaneous evolution *consist*?

"By the continuance of the powerful uterine contractions, the whole of the arm is protruded externally, the shoulder and chest being propelled low into the pelvic cavity. The acromion then appears under the symphysis pubis; and as the loins and breech descend into the pelvis at one side, the apex of the shoulder is directed upwards towards the mons veneris. Further room is thus gained for the complete reception of the breech into the cavity of the sacrum, and that part of the child's body is eventually expelled, sweeping the sacrum, and distending the perineum to a vast extent. As, during the whole of this process, the head remains above the pelvic brim, it is evident that, the apex of the shoulder being external, the clavicle must be strongly pressed against the under surface of the symphysis pubis; on which point, indeed, the fœtal body partially revolves, as on an axis; the other shoulder and arm, and the head, being expelled last."—*Ramsbotham.*

The first should always be practised when it is possible to do it, and the earlier (when the os uteri is in a condition to permit it) the better.

When the waters have been long drained off, and the os uteri and other parts of the uterus are firmly contracted so as to oppose the introduction of the hand, and the parts are pushed down low in the pelvis, turning cannot be permitted.

This condition should be counteracted by the free use of chloroform, or the lancet and opium; as soon as relaxation is induced, we may turn, unless the shoulder is too firmly wedged to permit it to be raised. When the child is dead, and in this condition, we may deliver by the use of instruments.

Prolapsus of the Umbilical Cord.

What *danger* is to be apprehended from prolapsus of the cord? It may be compressed, and the life of the child destroyed by the interruption to circulation.

How may it be *distinguished?* Before the rupture of the membranes, we may possibly feel a pulsating, projecting mass, like a finger; when the membranes are ruptured, the cord comes down, and may form a large coil.

What is the *treatment?* When left to itself, the child is generally destroyed, unless there is a very quick labor.

The remedies are generally *turning* and *delivery by the forceps.* It is also advised to make attempts at replacement, but it does not always succeed It may be well, however, to attempt it by passing it above the brim of the pelvis, and retaining it there by the introduction of a soft piece of sponge. When the labor advances very rapidly, sometimes perhaps the cord may be protected, by placing it in that relation to the head and pelvis where it will be least pressed upon.

Of Rupture of the Uterus.

What are the *causes* of rupture of the uterus? Blows, violent action of the uterus, violent pressure, ill-conducted attempts to turn the child, mal-adroit use of instruments, the unequal surface of the child, a contracted pelvis, an unusual sharpness of the linea ilio-pectinea, exostoses, tumors, scirrhi, and ulcers.

In what *portion* does it usually happen? It most commonly happens at or near its junction with the vagina, but may occur at any part. It may be more or less extensive, and may be *complete,* or *partial.* In the first case, the uterus and peritoneum are both ruptured; in the second, the uterus alone is involved.

What are the *symptoms?* There is sudden acute pain at the point of rupture, a discharge of blood, a cessation of uterine contractions, great consternation, the presenting part recedes, the face becomes pale and cold, the respiration hurried, and vomiting takes place; loss of sight, faintness, convulsions, and death, follow.

What is the *treatment?* Delivery should be effected as speedily and gently as possible.

Gastrotomy may be performed when the whole child has passed into the cavity of the abdomen, and it is impossible to seize the feet.

Of Turning, or Version.

What is meant by Turning, or Version? Bringing down one of the two extremities of the fœtus to the superior strait; it presents two varieties, *pelvic version* and *cephalic version.*

The cephalic version was practised by Hippocrates, and after him until the time of Ambrose Paré, when it fell into disuse, and was afterwards revived by Osiander.

What precautions are necessary to be observed in turning, of both kinds?

1st. The patient should be made acquainted with the kind of operation to be performed, the nature and objects of the same, and remove her fears as to the result, as far as possible.

2d. She should be placed in a proper position, respecting which a difference of opinion exists; we prefer the back, with the feet over the edge of the bed, or the same as recommended when the forceps are used.

3d. The coat of the physician should be removed, he should be protected properly, and napkins should be at hand.

4th. The position of the child should be ascertained immediately, before proceeding with the operation.

5th. The proper hand should be chosen before proceeding, and greased on the dorsal surface only.

6th. The os uteri should be dilated or dilatable, and the operation commenced when the bag of waters is still intact or recently ruptured, provided we have the privilege of selecting our time.

What is understood by *cephalic version?* It consists in bringing the summit of the head to the superior strait. It may be proper in irregular vertex presentations, when it is simply a correction of the head; in forehead presentations; in trunk presentations, before the rupture of the membranes; in breech cases, prior to the rupture of the membranes, where a vice of conformation exists, if it be possible.

This operation is difficult of performance, and many condemn it entirely; when it can be accomplished, it is safe for the child, but less safe for the mother than bringing down the feet.

What is understood by *pelvic version?* It consists in bringing the pelvic extremity to the superior strait.

What conditions are necessary in cases of version by the lower extremities? The os uteri should be dilated or dilatable, the presenting part should not be too long engaged in the excavation, and not cleared the neck of the uterus, and no disproportion exist between the size of the head and the pelvic dimensions. The neck may be considered as properly dilated when its orifice offers nearly two inches in diameter; or dilatable, when it will be found thick, soft, supple, and easily distended. If the part has descended low or escaped from the os uteri, it will, at least, endanger the integ

rity of the maternal structures to press it upward prior to the version; if such a proceeding be not in fact impossible. It should not be resorted to if disproportion exist, on account of the arrestation of the head after the body is delivered, and the liability to death of the child. If the small diameter of the pelvis is less than 3¾ inches, it will be improper. For *rules*, to be attended to in the operation, see pages 561 to 564.

What are the *difficulties* that may be met with in performing pelvic version? On the part of the mother, there may be excessive narrowness of the vulva, an obstinate resistance at the uterine orifice, spasmodic retraction and mobility of the body of the womb, and the insertion of the placenta over the uterine orifice. On the part of the child, there may be a shortness of the cord, unusual volume of the shoulders, crossing of the arms behind the neck, and extension of the head.

The *resistance* of the *vulva* can be overcome by care in introducing the hand, unless old adhesions exist. When the *uterine orifice* offers *resistance* too great for the introduction of the hand, and necessity for *immediate* delivery exists, we should resort to venesection, if plethoric; tepid bathing, fumigations, &c.; if these do not produce relaxation, or there is not time for their action to take place, it is recommended that incisions should be made into the cervix. For *retraction* and *spasmodic* action of the body of the womb, venesection and tepid bathing are our most reliable means. For *mobility*, the fundus of the organ should be kept steady by directing an assistant to place both hands over its superior and lateral parts.

The mode of overcoming the difficulties presented by *the placenta over the mouth of the uterus*, is given when speaking of unavoidable hemorrhage.

For *brevity of the cord*, the best mode, when it draws strongly on the placenta, is to cut and tie it.

When the *volume of the shoulders* is too great to permit an easy passage at the superior strait, oblique movements should be given to the portion of the child which is disengaged, by carrying the breech towards the groin of one side, and then towards the sacro-sciatic ligament of the opposite side, successively; and in this way cause an inclination of the bisacromial diameter, so as to engage it, one end at a time, in the superior strait.

Should the *arms cross behind the neck*, the mode of disengagement will depend upon their particular position.

Of Deliveries performed by Cutting Instruments applied either to the Mother or Child.

What are the *causes* which may render one or the other of these expedients necessary? *Deformity of the pelvis*, and *deformity of the child.*

What may be considered as the resources of our art in cases of *deformity of the pelvis? Forceps, cephalotomy, Cæsarian operation, premature delivery, section of the pubes*, and *regimen during pregnancy.*

What is the smallest diameter of the pelvis at the superior strait in which the forceps may be safely used? Three inches; then the head of the child should be of moderate size, yielding, and the forceps skilfully used. They are preferable to turning in most cases of deformity.

Under what circumstances may *Embryotomy* or *Cephalotomy* be resorted to? We may resort to the perforater and crotchet in cases where the antero-posterior diameter is $1\frac{1}{2}$ inch or more, and is so small that the head cannot be delivered by the forceps if the child is dead.

If the child is living, we should choose between this and the Cæsarian operation. A decided difference of opinion prevails between the English and French authorities, as to which of these expedients should be resorted to when the child is living. The English usually advise cephalotomy, where delivery is impracticable without diminishing the size of the head, or resorting to the use of cutting instruments applied to the woman, provided the above diameter of the pelvis exists; restricting the cases applicable to the Cæsarian section to those cases only where the diameter is less than the above; while the French generally prefer the Cæsarian section.

Accidental causes may render embryotomy necessary occasionally, such as hemorrhage, convulsions, and other anomalous states immediately and seriously threatening the life of the mother, and safe delivery be impracticable in any other mode. Never, under any circumstances, should this operation be performed unless the

mother's safety imperatively demands it; and this generally occurs from a disproportion between the size of the pelvis and the child. Sometimes perforation of the cranium alone will cause it to collapse by the pressure of the uterus, so as to permit expulsion by the natural powers, provided the pains be strong and frequent. The *instruments* required are of two kinds — the *perforating* and *extracting*. For the first, *Smellie's scissors*, (Figs. 38, 39,) and for the second, the *crotchet;* a variety of forceps have also been used, to assist in extracting the child after perforation. In performing this operation, it is not necessary to wait until the os uteri is *fully* dilated, although it is better that it should be so. The rectum and bladder should be emptied; and the woman placed in the position for turning and the forceps. Two fingers of the left hand should be placed against the most depending portion of the fœtal head; the perforator, warmed and greased, should be directed along the groove between the fingers until it comes in contact with the head, which it should be made to penetrate by a semi-rotary or boring motion, until it penetrates as far as the projections on the blades will permit; then the handles should be separated The cutting edges should then be placed at right angles, and again separated, so as to make a crucial incision. It should then be passed in so as to break up completely the structure of the whole brain. (Fig. 40.)

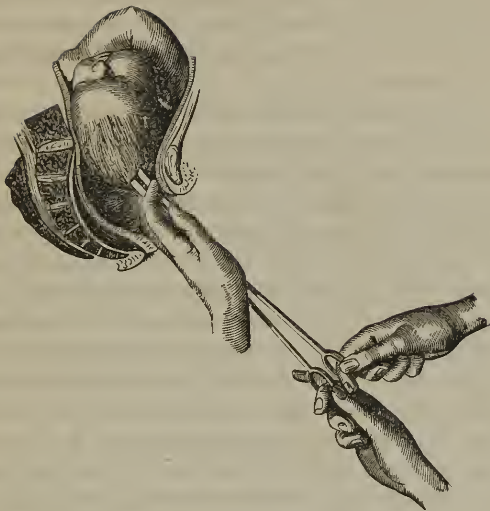
Fig. 38.

F .g. 39.

The crotchet may then be used, being very careful at the same time to guard the soft parts of the mother. If not practicable with the crotchet, some of the varieties of forceps in use should be resorted to.

Under what *circumstances* should the Cæsarian operation be performed? When the antero-posterior diameter of the superior strait, or the transverse diameter of the inferior, does not exceed $1\frac{1}{2}$ inch, which precludes delivery *per vias naturales*. The British practitioners never substitute it for craniotomy by choice, but only

Fig. 40.



have recourse to it when no other mode of delivery is practicable in order to save the life of the mother.

How should the *Cæsarian operation* be performed? The woman should be laid on a firm table or mattress, with the shoulders elevated: make an incision six inches in length through the abdominal parietes; by most operators, the linea alba is preferred for this incision, in which case it should extend from the lowest portion of the abdomen upwards; the opening through the peritoneum should correspond with the external incision. The uterus will then be exposed to view, through the side of which make an incision, commencing at the fundus, of sufficient extent to remove the child; this being done, the placenta should be removed, when the uterus will contract and sink into the pelvis. The bowels should be carefully protected by an assistant, and their protrusion prevented. The external wound should be carefully closed by sutures, adhesive straps, a compress and bandage.

What are the smallest diameters admitting of delivery *per vias naturales* by the crotchet? One and a half inch in the antero-posterior, and three or three and a half in the transverse.

What is understood by *Premature Delivery?* It consists in inducing labor artificially, at a period of pregnancy when the child is sufficiently developed to exist after birth, and yet so small, and the bones of the head so soft, as to pass through the contracted pelvis of the mother.

What is the proper *period* for its performance? The most eligible time is between the thirty-fourth and thirty-sixth week of utero-gestation; or, if the deformity be very considerable, we may commence operations as early as the thirty-second week. The operation should be delayed in all cases as long as it can be done safely, as by so doing the labor will more nearly resemble a natural one, and the chances of the child are increased

What is the mode by which it is *accomplished?* According to the directions of Dr. Rigby, we should first give a full dose of calomel and colocynth, so as to effectually clear out the bowels; then a warm bath; ergot should then be administered in scruple doses of the powder, and repeated every half hour for five or six times. These means will generally bring on labor; if they fail, a catheter should be passed, and the membranes separated from the uterus for some distance; if this fail, then the membranes should be ruptured. Others advise the rupture of the membranes, or their separation from the uterus, to precede all other means. The direction of a stream of cool water against the mouth of the uterus by means of a syphon and tube is highly recommended, and is probably the best mode of proceeding in such cases.

What are the benefits likely to result from a *section* of the pubes? It is an operation that is now almost universally condemned, and therefore not practised.

Puerperal or Peritoneal Fever.

What are the *nature* and *symptoms* of this disease? It is an affection of the peritoneum, infectious, and generally commences on the third day after delivery. The pain of the abdomen is slight at first, but soon becomes so violent as scarcely to admit of the patient's being able to bear the weight of the hand, or even the bed-clothes, upon the abdomen; and the feet are drawn up so as to flex the thighs on the pelvis. The face is flushed, afterwards becoming pale; there is irritability of the stomach, dark, loose, and

offensive stools; breasts flaccid, lochial discharge suppressed, breathing laborious, fever during its progress, which, if not so at first, becomes typhoid; and the teeth are covered with sordes.

What is the *treatment?* When the pulse is full, quick, and hard the abdomen swelled, hard, and painful, the patient should be bleo from the arm freely. Sometimes, when this disease prevails as ar epidemic, and the fever is of a typhoid character, local bleeding by leeches should be substituted for general, and a hot poultice applied to the bleeding orifices. Calomel and opium should be freely administered until a decided constitutional effect is produced; and the patient should also have the bowels freely moved with a purge of castor oil and spirits of turpentine, after a few doses of calomel and opium have been used. The diet should be light and unirritating, the room should be freely ventilated, and the patient kept quiet.

Puerperal Mania.

What are the *symptoms* of this disease? There is great volubility, and a disposition to use improper and indelicate language. It may be in most instances distinguished from phrenitis by the great throbbing of the vessels leading to the head, full and quick pulse, intolerance of light, and painful and suffused eyes, which attend this latter disease.

What is the proper *treatment?* The condition of the system should be carefully attended to; if there are symptoms denoting any degree of inflammation or of congestion, with a full pulse, bleeding should be practised, either general or local, depending upon the greater or less degree of plethora and inflammatory symptoms. The bowels should be opened, and mild preparations of mercury, with hyoscyamus and camphor, should be administered; and in other respects the condition of the system should furnish the indications for our procedure.

Phlegmasia Dolens.

What are the *course* and *symptoms?* It often occurs a week after delivery, and consists in a swelled condition of the leg and thigh; the skin becomes tense, smooth, and shining, very sensitive

and œdematous. It mostly affects but one limb, sometimes both. Its true pathology is involved as yet in some obscurity; but it is now believed to be a phlebitis attended with an effusion of lymph and adhesion; in fact, this view of its pathology may be considered as well demonstrated. It may sometimes be arrested in the beginning by the application of leeches to the painful part, and giving a brisk purge of calomel and jalap, or senna. In the more advanced stages, leeches should be applied; purgatives administered; and tartar emetic should be given in slightly nauseating doses, combined with nitrate of potassa or liquor of the acetate of ammonia. The swelling will remain for some time after the painful symptoms and fever have subsided, and may sometimes be relieved by bandaging the limb.

Diseases of Children.

Gum Rash. How *treated?* By aperients.

Jaundice. How *treated?* Give small doses of calomel, and follow them with castor oil.

Flatulent Colic. How *treated?* By warm bath, friction over the abdomen; change the nurse, and give Dewees's carminative, which is composed of tincture of assafetida, calcined magnesia, a small proportion of laudanum, and of water; the dose and proportions to be adapted to the case.

Convulsions. What are the *causes*, and how *treated?* The cause may be dentition, worms, an overloaded stomach, indigestible food in the stomach, hydrocephalus, or the non-appearance of some eruptions; an irritable or highly developed condition of the nervous system may be considered to be a predisposing cause.

If they proceed from an overloaded stomach, an emetic of ipecac, should be given; a warm bath at 97°, with cold to the head and spine; bleeding by leeches from temples, mercurial purges, and refrigerants, will all in their place be proper remedies to apply: if from teething, and this is a very frequent cause, the gums should be freely divided.

Dentition. What are the *symptoms*, and how should it be *treated?* Fretfulness, heat and swelling of the gums, starting in the sleep, a free flow of saliva, and the fingers are constantly in the mouth: this condition may cause convulsions, diarrhœa,

inflammation and congestion of the brain, fever, &c. The gums should be freely lanced quite down to the tooth, and the conditions produced by dentition should be treated on general principles, or as the symptoms may require.

Diarrhœa. What are the *causes*, and how *treated?* Teething is a frequent cause, and, when it is not, indigestible food may very often be found to be, or an over quantity of that which is proper; or it may be induced by high temperatures, particularly if conjoined with close, confined, and impure air. The cause should be sought out and removed, and with this the disease will often disappear. When it does not, mild mercurials, as hydrarg. c. cretâ, combined with a mild opiate, so as to correct the secretions, and diminish the exhausting discharge from the bowels at the same time, will be found highly beneficial; a mild oleaginous purge, conjoined with or following this prescription, is also often required.

Aphtha, or Thrush. What is the proper *treatment?* When diarrhœa attends, it should receive the principal attention; the best local applications to the mouth are borax and pulverized sugar, or honey; Armenian bole and honey; and chloride of soda in solution, sweetened.

Early Signs of Disease in Children.

What signs of disease are presented by the *face?* Pain occurring suddenly, and in intermissions, is generally from spasm in the bowels; when more permanent, it comes on gradually and insidiously. When seated in the head, the brow is contracted; in the belly, the upper lip is elevated; in the chest, there is sharpness of the nostrils. The change of expression of the countenance should be carefully noticed. Before convulsions occur, the face becomes convulsive, the upper lip is drawn, there is often slight squinting, or a singular movement of the eyes.

Suffusion of the face denotes fever, and diseases of general excitement.

Exhaustion is denoted by alternate flushes and heat, with paleness and cold, the pallor being more permanent; there is also a glazed and waxen appearance of the countenance.

What signs of disease are presented by the *gestures?* Convulsions are indicated by the thumb and fingers being drawn into the

palms, and the toes towards the soles, while the back part of the hands and feet are puffed and tumid; partial rigidity of other muscles is also indicative of spasms.

Spasmodic pain will cause forcible muscular contractions, while in inflammatory pain muscular efforts are avoided because pain is increased. The arms and hands are raised in pains of the head; when seated in the abdomen, the legs are apt to be drawn upwards.

Sleep. Pain and uneasiness will cause the brow to contract, and the mouth will be drawn; in the first, the pain is seated in the head; in the second, in the bowels.

Respiration. We should become familiar with the natural state of infantile respiration. It is accelerated in fever. When there is inflammation of the air tubes, there is difficult rattling or wheezing, or a cooing sound produced.

In all chest inflammations, the breathing is mostly abdominal; while in abdominal inflammations the chest is moved more freely. If the breathing is less audible on one side than the other, it indicates inflammation of the substance of the lung, or effusion of water.

The cry, if loud and free, indicates health. Perpetual crying is a symptom of pain. Inflammatory pains of the head, chest, or belly, check crying. A husky cry attends exhaustion.

The Breath. When fetid, the gums should be examined; it is also a sign of disordered stomach and bowels. The fur on *the tongue* is increased in disease; the tip is dry in fever, and in scarlet fever the papillæ are enlarged, red, and prominent.

PART VIII.

THEORY AND PRACTICE OF MEDICINE.

PART VIII.—THEORY AND PRACTICE OF MEDICINE.

OF DISEASE.

How may diseases be *divided?* Into *organic* and *functional.*

What is the character of the *first* class? There is a change which is appreciable by our senses, in the structure of one or more organs.

What is the character of the *second* class? The disordered function is not attended by any appreciable lesion.

Each of them may again be divided into *acute* and *chronic*, and *general* and *local affections.*

Which of the two classes is generally the more *fatal?* *Organic* diseases; but several of the *functional* are extremely mortal, as tetanus and hydrophobia.

What is meant by *local organic diseases?* Those in which the important symptoms are local, and are nearly in proportion to the anatomical lesions found after death, when it takes place. They may be acute or chronic.

What are the *general organic diseases?* They are often chronic, as tuberculous and cancerous diseases. The acute are certain epidemic dysenteries, fevers, scurvy, and gangrene. Tubercles are, however, sometimes acute.

Which are the more *manageable*, the general or the local diseases? The local. The general can rarely be cut short by remedies; the treatment for these is more useful in obviating the secondary inflammations that so often accompany them and prove the immediate cause of death, than in absolutely terminating the affection itself. Treatment is, however, important, as it enables us frequently to conduct diseases to a favorable termination which might otherwise prove fatal.

May *functional diseases* be either acute or chronic? Yes; and they constitute a large class of affections. Sometimes they are a symptom of an organic disease.

Do acute functional disorders ever *simulate* inflammations? They do; and it requires care and experience to discriminate them.

What are *instances* where they may be confounded? Pleurodynia with pleurisy; and local pains occurring in hysteria with the acute phlegmasiæ of the viscera.

How are they *distinguished?* Acute functional disorders commonly assume the form of neuralgia, in which the character of the pain contrasted with the slight vascular disturbance is sufficient to point out its true origin.

Are these acute affections always limited to *pain?* They are not; they assume, at times, every variety which the change in the function of an organ can produce, and are often difficult of diagnosis and treatment.

How is a *diagnosis* to be made in these doubtful cases? By *exclusion;* and by this means we can frequently affirm that the absence of unequivocal signs of organic lesion is conclusive proof that the disturbed function depends upon a cause which is connected with the nervous organization of a part, and not with a material change of the structure.

Are the chronic functional disorders sometimes mere symptoms of a distant local affection? They are; and at other times independent.

What are some of the chronic functional disorders? Most cases of mania, hysterical affections, many cases of dyspepsia, &c.

Are the functional disorders numerous? They are as numerous s the organic lesions, and much more difficult to manage.

Is classification arbitrary? It is; and the nomenclature also in nany instances.

What enhances this difficulty? The circumstance that many lesions which are separated as distinct diseases from others of a similar nature are in reality the effects, and not the cause of diseased action. Thus, the term *hydrothorax* is now seldom used; the symptoms to which it was applied are still observed; but it is now known that they depend upon a disease of the heart, and the effusion of serum into the cavity of the chest is only a consequence.

It is necessary, however, for convenience, to name, classify, and arrange the different forms of disease according to the facts we now possess.

Semeiology and Diagnosis.

What is meant by *semeiology?* The symptoms of disease studied with reference to the internal changes with which they correspond.

What is *diagnosis?* It is the art of distinguishing one disease from all others, and is based upon the comparison of the symptoms we observe in a particular individual with those known to exist in other cases, in connection with the order of time at which they appear. A more refined kind of diagnosis consists in determining the particular variety and stage of the disease, which includes *prognosis* or the art of determining the result.

What are the *signs* of disease? They are the *physical*, or those derived from a knowledge of the physical condition of the organs, obtained by physical examination; and the *functional*, to which the term symptom is usually confined.

What class of diseases admits of both these means of diagnosis? The organic; the functional can only be distinguished by the latter.

To what part are the physical signs particularly applicable? To diseases of the thoracic cavity, but they are by no means entirely confined to it.

From what are the *physical signs* derived? From an inspection of the exterior, from palpation or touch, and from auscultation and percussion.

What does *inspection* of the exterior of the body indicate? Distension, when a change of structure in the organs is sufficient to dilate the parietes. As in dropsy, tympanitis, extreme enlargements of the liver and other abdominal organs, emphysema, pericarditis, and pleurisy with large effusion. Pleurisy after adhesion has occurred, and phthisis, cause contraction.

What are the benefits of *palpation?* It assists ocular inspection. We can better estimate slight elevations, and also the degree of sensibility of the surface and internal viscera. If the degree of sensibility of the viscera is wished for, we press gently and equally with the whole hand; if of the surface, we pass the tips of the

fingers lightly over the skin. It also gives us a knowledge of the density, elasticity, and most of the physical properties of parts.

Of Percussion.

What *kind* of knowledge is derived by *percussion?* It enables us to distinguish the density of the part or organs beneath; as between a gas which gives a clear resonant sound, and a liquid or solid mass which yields a flat sound. We are therefore obliged to recollect what sound the part yields by percussion in a normal state, to determine the deviations in disease.

To what *parts* of the body has percussion been applied? To the thorax and abdomen.

Do all parts of the chest yield equally clear sounds on percussion in a state of health? No: the sound is more obscure in the region of the heart, and of the liver, along the vertebral column, and over the scapulæ.

What are the *modes* of performing percussion? By the direct application of it to the surface of the body, called *immediate* or *direct* percussion; and by applying some solid between the part percussed and the percussing body, and called *mediate* percussion. In percussing, the ends, and not the pulps, of two or more fingers should be used, being pressed together firmly; the strokes should be made with some force — however, so as not to give pain; they should be given in quick succession, and perpendicular to the surface of the body. When mediate percussion is used, the substance interposed is termed a *pleximeter*, which is made of various materials, such as ivory, gum elastic, &c.: the forefinger of the left hand makes the best one, as it is always at hand, and is uniformly of the same density.

How should the patient be *situated* during its performance? The walls of the part should be made tense, and to do this, when the anterior part of the chest is examined, the head should be raised and the shoulders thrown back; when the posterior part is examined, the head should be stooped and the arms crossed; when the side is examined, the arm of that side should be raised and the body inclined to the opposite side. If the part is covered during percussion, the covering should be drawn tight.

How is the thoracic surface *divided* for percussion? Laennec has divided it into fifteen regions, twelve of which are double.

Subclavian region. This includes the portion corresponding to the clavicle; it yields a clear sound about the middle and sternal extremity; whilst the humeral extremity yields a dull sound.

Antero-superior region. Bounded by the clavicle above, and fourth rib below; the sound is naturally clear.

Mammary region. Begins below the fourth rib, and terminates with the eighth; yields only a medium sound on account of the thickness of the pectoral muscle.

Submammary region.—Extends from the eighth rib to the cartilaginous border of the false ribs: on the right side, it gives almost a dull sound on account of the size of the liver; on the left side, it sometimes yields too clear a sound, almost tympanitic, on account of a distended condition of the stomach with gas.

Sternal regions. — *Superior, middle, and inferior.* Over the whole extent of the sternum the sound is clear as at the sternal end of the clavicle.

Axillary region. Commences at the upper part of the axilla, and terminates at the fourth rib inclusive; it yields a clear sound.

Lateral region. Commences beneath the fourth rib, and terminates at the eighth; yields a clear sound on the left side; on the right, frequently less so, on account of the liver rising higher than ordinary; the healthy liver seldom rises higher than the sixth rib.

Inferior lateral region. Extends from the eighth rib to the border of the cartilages of the false ribs; the right side here also, and for the same reasons, yields a much duller sound than the left, which is sometimes too loud, even when the lower part of the lung may be engorged, or the pleura contains a liquid.

Acromial region. Comprised between the clavicle and the upper edge of the trapezius muscle, head of the humerus, and the inferior part of the neck.

Superior scapular region. Corresponds to the supra-spinal fossa of the scapula, and yields but little sound.

Inferior scapular region. Corresponds to that portion of the scapula below its transverse spine, and here also but little sound is yielded.

Inter-scapular region. Comprised between the inner margin of the scapula and the spine, when the arms are crossed on the breast; not much sound obtained from it except in thin persons, and when the arms are forcibly crossed and head bent forwards.

Inferior dorsal region. Commences at the inferior angle of the scapula, and terminates at the twelfth dorsal vertebra; sound in this region rather obscure.

How does the natural resonance of parts vary in disease? It may be either *diminished* or *increased.*

What causes it to be diminished? An increase of density of the part; and it may be increased by an increase of gaseous matter.

What alterations may occur in the substance of the lung that give rise to *dullness?* Hepatization (in pneumonia), pulmonary apoplexy, and œdema, tubercles, and foreign growths.

The alterations external to the substance of the lung that may produce it are effusions into the pleura, or into the pericardium, tumors developed into the cavity of the pleura, hypertrophy of the heart, aneurism of the aorta, &c.

In what cases is the natural *resonance increased?* In pulmonary emphysema, and in pneumothorax.

What are the normal sounds obtained by percussing the abdomen? On its anterior surface it is *half-clear*, superiorly and on the right side it is dull from the situation of the liver; this dull sound ceases at the lower edges of the ribs; on the left, the spleen yields merely a slight dulness to the extent of one or two fingers' breadth in the region of the last false ribs; posteriorly, the sound is more dull in the region of the kidneys. If we wish to examine the parts near the skin, the pleximeter should be held superficially; but, when deep-seated organs are to be examined, considerable depression should be made. When examining the abdomen, the patient should lie on his back, and the muscles of the abdomen relaxed by flexing the legs on the thighs and the thighs on the pelvis, and mediate percussion should be employed. Percussion gives us no indication in regard to the bladder, uterus, or ovaries, in a healthy state, so that, when the regions corresponding to these organs give a dull sound, it is a morbid sign. The natural signs, together with the situation of each organ of the abdomen, should be carefully studied on the healthy subject, so as to be able to detect any departure from health in their physical condition.

In this manner, enlargements of the liver, spleen, abdominal tumors, distended bladder, &c., may easily be detected by percussion.

What are the different sounds yielded by percussion? They may be *tympanitic*, *clear*, *obscure*, or *dull;* there is also the *silvery* or *metallic sound.*

Under what circumstances is the *tympanitic* sound produced? In the thorax, in emphysema and pneumothorax; and in the abdomen, in cases of meteorism. The *clear* sound is that presented by the parts of the thorax mentioned.

The *obscure* sound is heard on percussing the chest when pneumonia is passing from the first to its second stage, and when the resolution of hepatization is going on; in bronchitis, when the lungs are engorged with mucus, &c. The obscure sound is usually the normal sound of the anterior region of the abdomen, when the abdominal parietes are of a medium thickness, and when the intestines are not distended with considerable gas.

The *dull* sound is heard when the lung is hepatized, or there is considerable effusion. There are different shades of dulness that it is necessary to recognize.

The *silvery* or *metallic* sound is a name given to the sound yielded by percussing the subclavian regions when they become the seat of tuberculous cavities. This sound also received the name of the *bruit de pot fêlé*, the sound of a cracked vessel It is also produced on percussing the abdomen, whether gases and liquids exist together in a portion of intestine; or whether each of these bodies is found separately in contiguous portions; or whether the gas is contained in the intestine, and the liquid in the peritoneum.

The *density* of the tissues percussed, and the elasticity of the parts near the surface, may be ascertained by percussion.

Of Auscultation.

What is meant by *auscultation*? It is the art of distinguishing by the ear sounds produced in particular parts of the body in health and disease.

What are the *general rules* for auscultation? They are divided into those having reference to the patient, and into those to be observed by the physician.

Rules relative to the Patient. The part explored should be

naked, or covered with some thin, pliable material; thick and woollen articles should not be used.

The patient should be placed in a convenient position, which must vary according to his affection.

Rules relative to the Physician. Place himself on the side he wishes to examine generally; sometimes the contrary is preferable, the right and left side should be explored without change of position, unless the case is one of doubt. On the same side, apply one ear to the front, and the other to the back, so as to be accustomed to the use of each organ indifferently. The ear simply, or the stethoscope, may be used; when the ear alone is used, it is called *immediate;* when the stethoscope, *mediate.* Both of these methods have their peculiar advantages, and the selection must depend upon circumstances which vary. Immediate auscultation, for instance, cannot always be employed in cases of females, or in certain regions, as the supra and subclavicular, the axilla, groin, &c., where the ear could with difficulty be applied, especially in thin people; there are also other circumstances which may give the preference to the stethoscope. Both methods should be practised, and one or the other used according to circumstances.

If the ear is preferred, apply it accurately, so as to follow the movements of the chest, without friction.

If the stethoscope, it shonld be held like a pen, and placed evenly and perpendicularly on the part to be examined; the pavilion of the ear should be applied to the horizontal plate of the instrument, which should press moderately on the part under examination. The two sides should be comparatively explored, as it will better enable the auscultator to detect differences of sound. Great care should be taken in making the examination; everything should be quiet around; the different sounds should be carefully analyzed, and those sought after and carefully distinguished that belong to the organ under examination, to the exclusion of the other sounds that may be often heard; the attention should be abstracted from everything except that which pertains to the sounds, and the pathological explanation of them.

To what *parts* may auscultation be applied? The chest, neck, abdomen, head, and limbs; but it is to the chest where it is particularly applicable and useful.

AUSCULTATION OF THE CHEST.

How is this *divided?* Into auscultation of the *Respiratory* and of the *Circulatory Apparatus.*

AUSCULTATION OF THE RESPIRATORY APPARATUS.

Upon what parts is this performed? The chest, and the laryngo-tracheal tube; and has for its objects the phenomena furnished by the *respiratory murmur*, the *voice*, and *cough.*

Respiratory Murmur.

How should an examination of the respiration be made? The position of the *patient* should vary with the parts examined; if *anterior*, he may stand, sit, or lie on his back; if *posterior*, he may stand or sit, with the arms folded or crossed in front; if *lateral*, the patient may lie on the opposite side, sit or stand; and the arm should be separated from the body, and sustained in that position. The patient should breathe freely, but without any exaggerated effort; the movements of the thorax should be observed and taken into account in making up an opinion of the degree of strength of the respiration. In some cases, it may be necessary to cause a deep and quick inspiration, for the purpose of producing sounds sufficiently audible to be properly judged of.

The *physician* should be conveniently and easily situated, with his head not too low: for the upper and anterior part, use the stethoscope; lower down, employ the ear direct, except in females; posteriorly and laterally, use the ear: the examinations should be made on both sides, and the comparisons made in corresponding points; it should also extend over the whole chest.

PHYSIOLOGICAL PHENOMENA.

Normal Respiration.

What are the *characteristics* of normal or healthy respiration? If every part of the function of respiration is properly performed, and the ear is properly applied, a soft regular murmur is heard,

analogous to the sound produced during a tranquil slumber, or by a deep sigh; this is the *natural respiratory* or *vesicular sound*, or *murmur*. It is principally heard during inspiration, which is considered to bear a proportionate intensity and duration to the expiration, that would be represented as 3 to 1, so that there are two distinct sounds, one of inspiration and the other of expiration. It is heard over all portions of the chest, but varies in intensity in different parts, and under different circumstances of age, strength of constitution, and frequency of respiration. The intensity is greatest over parts corresponding with dense and superficial masses of pulmonary structures; as in the hollow of the axilla, lateral, antero-superior and postero-inferior parts of the thorax; quick breathing, bodily exertion, mental emotions, &c, will also increase it.

What is understood by the *tracheal and laryngeal respiratory sounds?* They are sounds produced in the trachea and larynx during inspiration and expiration, and may be heard by applying the stethoscope over these parts.

So that we have sounds produced in different portions of the pulmonary system, varying according to difference of texture, laryngeal in the larynx, tracheal in the trachea, bronchial in the bronchiæ, and vesicular in the air-cells; all of which may be modified by disease.

PATHOLOGICAL PHENOMENA.

How are the pathological modifications of the respiratory sounds arranged? Into alterations in *intensity*, in *rhythm*, in *character*, and those caused by *abnormal sounds*.

What are the varieties of *intensity?* *Loud* respiration; *feeble* respiration, and *absent* respiration.

What are the varieties of *rhythm?* They relate to the *frequency*, *continuity*, and *duration* of the respiration.

What are the varieties of *character?* *Harsh*, *bronchial*, *cavernous*, and *amphoric* respiration.

What are the varieties of *abnormal sounds?* *Sound of friction* and *râles*.

ALTERATIONS IN THE INTENSITY OF THE RESPIRATORY MURMUR.

Loud Respiration.

What are the *synonymes* and *characteristics* of loud respiration? The *synonymes* are *puerile, exaggerated, supplementary,* and *hypervesicular.*

The *characteristics* are, vesicular murmur of greater intensity than natural, with the natural softness; the inspiration and expiration are more noisy and lengthened, but their relative duration remains the same. It may be confounded with the harsh, and possibly with the bronchial or cavernous respiration. In the harsh, the expiratory sound is relatively longer, also in the bronchial.

What *signification* has it? Deficient action in the other lung, or some other portion of the one examined; which may be caused by pleuritic effusion, tubercles, or anything that may render their air-cells less permeable. It indicates disease, but does not point out its seat or nature.

Feeble Respiration.

What are its *characteristics?* A diminution from the natural respiration, either slight or considerable.

What *signification* has it? It may be produced by pleuritic effusions, and pulmonary adhesions on the same side; by pleurodynia, emphysema, partial obstruction of the air-passages, and by compression of the bronchiæ from tubercles, cancer, melanosis, &c. It occurs in numerous affections, and its value as a diagnostic must depend upon its relation to other signs.

Absent Respiration.

What is understood by absent respiration? It is when no sound whatever can be perceived on the application of the ear to the chest.

What *signification* has it? Almost the same conditions exist as in feebleness, except that an advanced degree of abnormal lesion is indicated. It may, like feeble respiration, also be local or general, momentary or permanent.

ALTERATIONS IN RHYTHM.

Frequency of Respiration.

What is the natural frequency of respiration? In adults, eighteen to twenty-two in a minute; and, in children, twenty-two to twenty-six. Disease may either increase or diminish the number.

What *signification* has it? None that is precise; pathological slowness is generally connected with disease of the cerebro-spinal system; great acceleration only indicates extensive or serious lesion of the thoracic organs, without indicating the kind.

Continuity of Respiration.

How is this affected by disease? In the normal state, the vesicular murmur is continuous in both acts of respiration. In disease, it is sometimes interrupted, constituting what is called abrupt respiration. It is chiefly observed in inspiration, and takes place at intervals. Sometimes without alteration in intensity and character, and sometimes with feebleness or harshness; it may be occasional, and at other times always discovered when an examination is made.

What does it *indicate*? It may be caused by intense pleurodynia and asthma; but if it cannot be attributed to either of these, a tuberculous affection accompanied with pleurisy may be suspected; and detected, if it exist, by its appropriate signs.

Duration of Respiration.

What are the *alterations* in duration? Sometimes the absolute duration is changed, without change in the normal relations of the duration of inspiration and expiration; and sometimes the relative duration of inspiration and expiration is changed.

The most important alterations are in the relative duration of the two acts. The inspiration may be longer or the expiration shorter, which variety is of little value in diagnosis. On the other hand, the expiration may be prolonged, while inspiration is normal or shortened; and this constitutes an important variety, termed *prolonged expiration.*

Prolonged Expiration.

What are the *characteristics?* The expiratory sound is increased in duration, and, as it progresses, approaches to that of inspiration, and, finally, surpasses it, and produces an inverse proportion between the two acts as they occur in the physiological condition.

What *signification* has this sign? It occurs permanently in the first stage of phthisis, and in emphysema. In emphysema, the change is principally in the duration, with a sibilant rhonchus; while in tubercles, harshness forms an important portion of it, and it is often the first stethoscopic sign of phthisis; which renders it valuable.

ALTERATIONS IN CHARACTER OF THE RESPIRATION.

What are they? They are designated as the *harsh*, *bronchial*, *cavernous*, and *amphoric*.

Harsh Respiration.

Synonyme. Grating Respiration.

What are the *characteristics?* It presents different degrees of intensity, duration, and dryness. The alteration may affect both acts or one; the expiration is prolonged, and the first becomes harsh; which harshness afterwards extends to inspiration. The phenomenon occupies principally the upper portion of one or both sides of the chest, is generally permanent, does not vary rapidly usually, although sometimes it advances with great rapidity, and continues to augment until it approaches the character of the bronchial.

What *signification* has this sign? It is caused by thickening of the walls of the air-cells, induration of the pulmonary parenchyma, or, more rarely, dryness of the mucous membrane of the bronchiæ. It is a very common modification of morbid respiratory sounds; it occurs sometimes in the commencement of acute bronchitis; in emphysema, with thickened walls of the dilated air-cells; in incipient phthisis; and, in short, in every case of induration of the substance of the lung. When it continues and is accompanied with dullness, it is almost a certain indication of phthisis; but if with excessive sonoreity, of emphysema.

Bronchial blowing, or Tubular Respiration.

Synonymes. Tubular blowing, bronchial blowing, blowing respiration.

What are its *characteristics?* There is an increase of intensity, and a higher tone, which is well imitated by blowing through the nearly closed hand, a roll of paper, or a stethoscope; the different degrees of it being produced by the quickness and strength with which this is done. It has several degrees of intensity, extending intermediately from simple harshness to the true blowing sound. It may extend over every part of the chest, but affects chiefly the posterior and inferior regions. Its phenomenon is continuous and permanent: when not well marked, it is difficult to distinguish it from harsh respiration.

What is the *signification* of this sign? It may be caused by a silence of the vesicular murmur; by the air traversing the bronchial tubes rapidly; and by increased elasticity of pulmonary tissue from induration, which renders it a better conductor of sound. It is heard in cases of uniform dilatation of the bronchiæ; in cases of induration of the lung from any cause, as tubercles, inflammation, cancer, melanosis, apoplexy, &c.; also in some cases of pleuritic effusion. This becomes a valuable sign in diagnosis, when taken in connection with other symptoms, physical and functional. It generally indicates induration; and of the different indurations, those from tubercles and pneumonia are by far the most frequent.

Cavernous Respiration.

Synonymes. Cavernous blowing, hollow respiration.

What are its *characteristics?* It resembles the sound produced by blowing into a hollow space; it is generally found at the apex of the chest on one or both sides, rarely at the base; it is of limited extent, permanent, and when well marked has a particular tone. It is produced by air arriving in abnormal cavities, which may be caused by a pouch-like dilatation of a pretty large bronchia; or by the existence of a cavern in the substance of the lung, a knowledge of the cause of which must depend upon the history of the disease, and other symptoms; as a cavern may be produced by different pathological conditions, although in nine cases out of ten it is the result of the breaking up of tubercles.

Amphoric Respiration.

Synonymes. Amphoric blowing, amphoric buzzing, metallic blowing.

What are its *characteristics?* It is a resonant sound of a metallic tone, that may be imitated by blowing into a jug three parts empty, or into a glass bottle with a narrow neck. It supplants completely the vesicular murmur, and is heard better during the first act of inspiration. It almost always coincides with metallic tinkling.

What does amphoric respiration *indicate?* A large cavity, either in the substance of the lung, or formed by the pleura, and communicating with the bronchiæ by a narrow orifice, and containing air. It is generally most perceptible at the middle of the chest; and exists in pneumo-thorax, pneumo-hydrothorax, and in extensive pulmonary excavations, whether occurring from tubercle or gangrene.

ABNORMAL SOUNDS.

How are they *divided?* Into those occurring in the bronchiæ and pulmonary tissue, which are termed *râles;* and that produced at the surface of the lung, and termed the *Friction sound.*

What are the *Friction sounds? Pleuritic friction.*

How are the *Râles* divided? Into two groups: the *Dry*, and the *Moist.*

What are the *dry* râles? The *Sibilant* and *Snoring,* included under the term *Sonorous.*

What are the *moist* râles? *Crepitating râle. Sub-crepitating râle. Cavernous râle.* To which may be added *Crackling,* and *Crumpling.*

Pleuritic Friction.

What are the *characteristics?* It resembles the friction of two hard substances, which glide slowly over each other. It is mostly heard during inspiration, but sometimes in both; or only at the end of long inspirations; and is continued or intermittent.

What does it *indicate?* A roughened condition of one or both surfaces of the pleura, and which is generally produced by false membrane deposited on its surface as a result of inflammation.

Râles.

How are they defined? They are defined to be "all abnormal sounds which the current of air may produce during the respiratory act, either by traversing liquids, which are present in the bronchiæ or the pulmonary tissue, or owing to a partial stricture of the air passages."

FIRST GROUP. — DRY RÂLES.

Sonorous Râle.

Synonyme. The *dry sonorous* or *bronchial râle,* comprehending two varieties — the *acute sonorous,* or *sibilant râle,* and *deep sonorous* or *snoring.*

What are their *characteristics?* The *sibilant* râle is a musical whistle of an acute tone, which accompanies or disguises the respiratory murmur; sometimes it is short and clacking; at others prolonged, and resembles the cooing of a turtle-dove. The *snoring* râle has a deeper musical sound, similar to the snoring of a person asleep, or a bass sound. The sibilant is the most frequent, but it may be combined or alternate with others. This râle may be heard in inspiration, or in expiration, or in both.

What does it *indicate?* Acute or chronic inflammation of the bronchiæ, without much secretion; tumors in the course of these canals; or emphysema. In the majority of cases, it indicates bronchial inflammation.

SECOND GROUP. — MOIST RÂLES.

Crepitating Râle.

Synonyme. Versicular râle.

What are its *characteristics?* It resembles fine rapid crepitation in the sensation produced on the ear. It has been compared to the crepitation of fine salt when thrown on the fire; the friction of the hair rubbed between the fingers; the sound produced on compressing the tissue of a healthy lung filled with air, &c.; and is heard only in inspiration.

What does this râle *indicate?* It is heard in pneumonia at the commencement, and when resolution begins to occur; in active forms of pulmonary congestion, œdema, and in apoplexy of the lungs. From the comparative rarity of the other affections, it may be considered as almost pathognomonic of pneumonia, at the period of congestion, the particular seat of which it also points out.

Sub-crepitating Râle.

Synonymes. Mucous râle, moist bronchial râle.

What are its *characteristics?* It resembles the noise caused by blowing with a reed into soapy water, and like this varies according to the diameter of the reed, the density of the liquid, and the force of the blowing; this difference has caused the division of this râle into three varieties, according to the quantity and size of the bubbles. In some cases, the number and fineness of the bubbles cause it to approach the crepitating râle, and then it is called *fine* sub-crepitating râle; in other cases, they are larger, less numerous, and less equal, and called *intermediate* sub-crepitating râle; again they are large, rare, and very unequal, amounting to *gurgling*, and are called the sub-crepitating râle with *large* bubbles. At one extreme this râle may be easily confounded with the crepitating râle, and at the other with the cavernous.

How is it distinguishod from the crepitating? It is heard both in inspiration and expiration, occupies a larger surface, and is not accompanied or followed by bronchial blowing.

How from the cavernous? By the cavernous coinciding with the cavernous respiration, cough, and voice. Sometimes all these different râles may be heard in the same case at the same time, and render the discovery difficult.

Under what *circumstances* may this râle occur? It is produced by a current of air passing through liquids (blood, mucus, or pus); and may be heard in the second stage of inflammation of the bronchial mucous membrane, the different species of catarrh, hæmoptysis, dilatation of the bronchiæ with increased secretion, certain forms of congestion, and in phthisis at the commencement of the breaking up of tubercles; the first and last of these are the most frequent.

Cavernous Râle.

Synonymes. Gurgling (Gargouillement).

What are its *characteristics?* The bubbles are less numerous than in the sub-crepitating râle, large and unequal, and mingle with the cavernous respiration, and may occur either during inspiration or in expiration, or in both acts.

What does it *indicate?* A cavity or cavities hollowed out of the pulmonary structure, and containing both liquid and air; they may be the result of tubercles, gangrene, abscess, or of the softening of an apoplectic deposit; it may also be caused by a pouch-like bronchial dilatation. If it exist with a cavernous voice, it indicates a tuberculous excavation almost certainly.

Crackling, Crumpling, etc.

Under what *circumstances* do these sounds occur? They appear to be connected with the existence of pulmonary excavations, but in what precise manner seems not to be well understood. Crackling is a succession of small and generally not numerous cracklings, which are heard only during inspiration, and usually at the summit of the chest; and when moist, indicate softening of tubercles.

Auscultation of the Voice.

How should this be performed? The posture should be as in auscultation of the lungs; the patient should speak with a certain uniform energy, and intensity of sound; and to which we should become accustomed by causing him to read aloud and cough. The ear alone is preferable in bronchophony, and in œgophony; in pectoriloquy, the stethoscope should be used, and care taken not to press the head too firmly against the instrument, neither too lightly, but moderately and uniformly.

PHYSIOLOGICAL PHENOMENA.

What are they? Over the larynx, when speaking, there is ob served a pealing resonance which traverses the tube of the stethoscope, and strikes the ear forcibly; the same in the lateral portions of the neck; the resonance is loud at the sub-sternal portion of

the trachea, and diminishes in the large bronchiæ; when the thoracic organs are in perfect order, we hear over the chest only a confused buzzing, varying in intensity according to the parts of the chest, tone of voice, &c.

PATHOLOGICAL PHENOMENA.

How is the voice modified? When the physical condition of the lungs, &c., is changed, it produces a corresponding modification of the voice; the density being increased, the resonance is also increased in proportion. Caverns in their substance, effusions into the pleura, &c., cause their corresponding modifications also.

What are the pathological modifications of the voice? *Exaggerated resonance. Bronchial voice*, or *bronchophony. Bleating voice*, or *ægophony. Cavernous voice*, or *pectoriloquy. Amphoric voice.*

Of the cough? *Bronchial* or *tubular. Cavernous* and *Amphoric* cough.

Exaggerated Resonance of the Voice.

Synonyme. Weak Bronchophony.

What are the *characteristics?* It is an increase of the resonance, but does not amount to real bronchophony. Its signification is the same as bronchophony, in a less degree.

Bronchial Voice, or Bronchophony.

Synonymes. Tubular Voice, Buzzing Voice.

What are the *characteristics?* There is a loud resonance of the voice in the interior of the chest; sometimes clear, at others tremulous, and more frequently heard posteriorly than anteriorly; and is of variable extent. It is distinguished from pectoriloquy by being widely spread, and by the absence of cavernous respiration and râle.

What does it *indicate?* The same condition as exists with bronchial respiration, viz.: dilatation with induration of the bronchiæ, in which cases percussion is clear, increased density of the pulmonary parenchyma from crude tubercles, inflammation, cancer, &c., in which there is dulness; the tubercles and inflammation are much the most frequent condition.

Bleating Voice, or Œgophony.

What are the *characteristics?* It is a resonance of an acute, tremulous, and abrupt tone, analogous to the bleating of a goat; which accompanies the articulation of the words, or rather follows them like an echo.

What does it *indicate?* True œgophony indicates a liquid effusion into the cavity of the pleura, through which the vibrations are transmitted to the ear; it therefore is produced by pleurisy or hydrothorax.

Cavernous Voice, or Pectoriloquy.

What are its *characteristics?* The voice seems to issue directly from the chest, and to pass through the hollow of the stethoscope to the ear.

What does it *indicate?* It usually indicates a tuberculous excavation, although cavities may occur in the lungs from other causes; for a cavity to produce pectoriloquy distinctly, it should be superficial, not large, smooth, nearly empty, and have thin, but solid walls; although imperfect varieties may occur without all of these conditions.

Amphoric Voice.

What are the *characteristics?* It resembles or is precisely similar to the metallic and cavernous buzzing produced by speaking into the mouth of a jug, which is three parts empty.

What does it *indicate?* The same conditions that produce amphoric respiration.

Metallic Tinkling.

What is understood by metallic tinkling? It is a sound accompanying the respiration, voice, and cough; it generally coincides with inspiration; and the sound has been compared "to that emitted from a cup of metal, glass, or porcelain, when struck gently with a pin, or when a grain of sand is dropped into it." The voice and cough more constantly excite it than respiration; it is sometimes permanent, or produced whenever the patient speaks or coughs, and at others only by a violent paroxysm of coughing.

Under what circumstances is it produced? There must exist a large cavity containing liquid and gas; and there must be a move-

ment imparted to the fluids enclosed in it; it is therefore found in pneumo-hydrothorax, whether simple or complicated, with fistulous communication between the pleura and bronchiæ, and in a large excavation hollowed out in the centre of the pulmonary parenchyma. Tuberculous excavations are rarely of a size and kind to produce it; and it may be considered as pathognomonic of a triple lesion, viz: of pneumothorax, liquid effusion, and fistulous communication of the pleura with the bronchiæ.

Auscultation of the Heart.

PHYSIOLOGICAL PHENOMENA.

What are the physical circumstances to be observed in the auscultation of the heart? Its *impulse*, its *rhythm*, and its *sounds*.

What is understood by its *impulse?* It is a shock perceived by the examiner on placing the hand on the left side of the chest below the nipple, or by the points of the fingers upon the space between the fifth and sixth ribs anteriorly; and is caused by the stroke of the heart against the parietes of the chest. It is nearly or quite synchronous with the pulse of the wrist, and with the systole or contraction of the ventricles. It varies with the strength of the individual; and it is also variable in frequency.

What is understood by the *rhythm* of the heart? In ausculting the heart, certain sounds are heard which occur with regularity, occupy a certain uniform time, succeed each other in regular manner, and have a given and uniform interval occurring between them, in each complete circuit of the heart's action. This regular division of the time constitutes its rhythm. The length of time occupied by these sounds, and by the interval, may be altered in disease, or from other causes, which constitute derangement or irregularity of the rhythm. The rhythm, of course, depends upon certain regular actions and conditions of the heart, and its appendages.

What is understood by the *sounds* of the heart? They are sounds heard on applying the ear to the chest over the region of the heart; they are two in number, and have been represented by some as a *tic-tac*. Williams employs the word *lubb-dup* or *lubb-tub*. Others think that the syllables *too-to* — *too-to* — represent these

sounds. They may easily be heard in a healthy person, and this constitutes their best description.

What are the *causes* of these sounds? The *second sound* is caused by the sudden closure of the sigmoid valves after the contraction of the ventricles has ceased, or during their diastole. The *first sound* is believed by some to depend entirely upon the closure, in like manner, of the auriculo-venticular valves. But, by the majority of experimenters and physiologists, it is believed to depend upon the *bruit musculaire* of the auricles and ventricles in contracting; upon the sound produced by the *chordæ tendinæ* when put upon the stretch; upon the closure of these valves, and the *friction* of the blood.

Is there any difference in different persons in regard to the extent over which these sounds are heard? There is: they are heard more extensively in a thin than in a fat person; in a small than in a large person; in a person of irritable disposition than in one of a calm temperment; in females more than in males. The extent is also changed in certain diseases, both of the heart and lungs.

The first sound is heard most distinctly over the junction of the fifth rib with its cartilage; while the second sound is most clearly audible on the sternum near the third intercostal space of the left side.

PATHOLOGICAL PHENOMENA.

The Impulse.

What relation does the impulse bear to the pulse? Unless some mechanical impediment exist to the course of the blood, they will be found to correspond both in time and strength; when the pulse is strong and vigorous, so with the impulse; when the former is weak and tremulous, the latter will be feeble also.

Under what *circumstances* is the impulse *increased?* In hypertrophy, with some exceptions; and particularly when dilatation is connected with hypertrophy. In these cases, it is full, strong, and heaving.

What does a *sharp* and *smart* impulse *indicate?* It exists in nervous and excitable persons who labor under chlorosis, or anæmia from other causes; and should be carefully distinguished from a powerful impulse, as it is indicative of an entirely different condition.

Under what *circumstances* is there a *diminished* impulse? When the parietes of the heart are thin and weak, pale and flabby, or loaded with fat; and when there is effusion into the pericardium. It may also exist, even in hypertrophy, when the action of the heart is hampered by obstruction of the valves, and its contractions overpowered by an accumulated fluid. Under some circumstances, therefore, a powerful heart may present a feeble impulse; and very frequently a feeble heart will present a smart smacking one, but without power and fullness.

The Rhythm.

Under what *circumstances* is the Rhythm of the heart changed? It may occur from great or sudden emotions of the mind, and also from physical causes; or by anything that will cause an interruption of the regular successions of contractions and dilatations of the auricles and ventricles.

What are the *organic changes* that may affect it? Disease of the valves; thinness, dilatation, or weakness of the parietes of the ventricles; and effusions into the pericardium.

The Sounds.

What are the general changes that may occur in the sounds of the heart? They may be *unnaturally increased*, *unnaturally diminished*, or altogether *abnormal* in their characters.

Under what *circumstances* is there an *increase* of the sounds? It may occur when the surrounding lung is consolidated, and where the chambers of the heart are dilated, or the parietes thinner than natural.

When the sounds are loud, as well as clear, it will generally be found that there is enlargement of the cavities: when clear or shrill, without being particularly loud, the parietes are commonly thin, but not dilated.

Under what *circumstances* is there a *decrease* of the sounds? Anything which interferes with the free action of the heart itself, or impedes the free motion of its valves. The physical conditions causing it are, over-distension of the organ; effusion into the pericardium; stiffness or want of pliancy in the valves, even when insufficient to produce a murmur: and they may be obscured by murmurs of one of the valves, pericardial murmurs, and bronchial

rattles, or they may be destroyed by these altogether. An unnatural thickness of the walls or hypertrophy may also prevent their being heard so loud.

Abnormal Sounds or Murmurs.

By what means are the *morbid sounds or murmurs* of the heart produced? By the passage of the blood through the valves. There may be an unusual harshness, merely, of the natural sounds; or only a slight puff or whizzing noise, resembling that produced by a pair of bellows — called the "*bellows murmur*" (*bruit de soufflet*); or like that caused by rasping or filing wood — "*rasping murmur*" (*bruit de râpe*); or like that arising from sawing wood — "*sawing murmur*" (*bruit de scie*); or it may approach to the tone of certain musical instruments, as of a bass-viol, a bassoon, or oboe — "*musical sound.*"

At what part may the sounds of the different valves be most distinctly heard? The valves of the pulmonary artery are situated almost exactly opposite the junction of the cartilages of the third rib with the left side of the sternum, at which point murmurs connected with them may be most distinctly heard, and sound as though they were superficial.

The aortic valves are behind those of the pulmonary artery; one perpendicular section would divide part of both, although as a whole the aortic valves are about half an inch to the right of, and lower down than the pulmonary. The diseases of the aortic valves are accompanied with a more superficial sound than those of the pulmonary; it is heard more distinctly over the sternum, near its junction with the third rib of the left side, or the space between the third and fourth; also it is heard in the course of the aorta upwards and to the right, extending nearly as high as the clavicle or top of the sternum.

The mitral valve is situated about opposite the space between the cartilages of the fourth and fifth ribs of the left side, over which their murmurs are most distinctly heard; or immediately below the nipple.

The tricuspid valve is considerably to the right of, and anterior to, the mitral; and it is for the most part covered by the sternum. Murmurs resulting from disease or imperfection in them are usually loudest over the central and lower part of the sternum.

What is the general *division* of the murmurs? They are those of *regurgitation*, and those of *obstruction*.

What causes the murmurs of *obstruction?* They are caused by some obstruction to the forward progress of the blood.

What causes murmurs of *regurgitation?* The walves may be contracted or stiffened, or the openings they are designed to close may be enlarged, so that the valves cannot close them; or they may be rent or ulcerated so as to admit of the backward passage or regurgitation of the blood, by which sound is produced. These murmurs may therefore be caused by a direct passage through a contracted valve; or from a retrograde motion through an imperfect valve; or from both causes combined.

How may two murmurs, one obstructive, and the other regurgitative, occur at the same time, and therefore produce but one sound? While the blood is passing through one valve which may be obstructed, it may at the same moment be passing backwards against another, which, if it should be imperfect, may permit regurgitation; and thus both sounds may be produced at the same time.

In what manner is a *double* murmur produced? A murmur may be caused by the direct passage of blood, and the same valve may also close imperfectly and permit regurgitation; thus giving rise to the obstructive and the regurgitative murmurs; one following the other in quick succession, and produced at the same valvular opening.

What are the *characteristics* of murmurs of the *aortic* valves? When regurgitative, it is heard most distinctly over the sternum opposite the third rib; it occupies the time or place of the second sound of the heart, and often entirely conceals it. When both obstruction and regurgitation exist at these valves, there is a double murmur, or "*see-saw,*" which is heard at the same point, and passes upwards in the course of the aorta, gradually decreasing in power.

What are the *characteristics* of murmurs of the *pulmonary* valves? Similar sounds to the above, occurring opposite the second intercostal space; confined to that situation, and not following the course of the aorta, indicate the same conditions of these valves.

What are the *characteristics* of regurgitative murmurs of the

mitral valve? They accompany or occupy the time and place of the first sound of the heart; are heard most distinctly below the nipple; but audible in the axilla, and in the left inter-scapular region close to the spine or over it. They may be caused by disease of the valves, and also by dilatation of the orifice, so as to prevent its closure by them.

What are the *characteristics* of murmurs caused by obstruction of the aortic valves and regurgitation through the mitral valves? They occupy the time of the first sound of the heart; are equally loud behind the sternum, opposite the third rib, and below the nipple; heard also opposite or below the angle of the scapula near the spine.

In studying diseased sounds of the heart, always bear in mind the physiological condition, and then connect the diseased sounds with the action of the heart in regard to the position in which they are heard, and the time of their occurrence relative to the healthy sounds that are heard; remember the action of the valves, and the origin of the murmurs, obstructive and regurgitative, and the diagnosis of valvular sounds will be comparatively easy.

On which side of the heart do valvular murmurs usually occur? They are much more frequently on the left than upon the right side; and murmurs of the mitral valve are much more frequently caused by regurgitation than by obstruction.

Do murmurs always indicate either obstruction from valvular disease or regurgitation from imperfection? Sounds resembling murmurs may occur from diseases of the pericardium; and any solid substance of sufficient density projecting inwards from the parietes of the heart or large vessels, so as to encroach upon the channel through which the blood passes, may act upon the fluid in such a manner as to give rise to a variety of murmurs. This condition may often be produced by anything pressing upon the column of blood while in motion; when the pressure is not sufficient to obstruct it entirely; this may be done by an aneurism, or by a stethoscope, or by other means.

Is valvular disease always accompanied by murmurs? Not always; it is necessary for their production that an obstruction of some kind should exist, and also that there should exist a certain force in the propulsion of the blood; so that sometimes the obstruction or condition may exist, and yet when the patient is quiet

the force of the circulation is not sufficient to produce them. The heart may be greatly distended and weakened, and incapable of acting upon the blood with sufficient force to produce the sounds spoken of. It may, likewise, be oppressed by a fluid from without, in the pericardium, so as to produce the same effect.

Anœmic Murmurs.

What is understood by anæmic murmurs? They are murmurs that occur in certain states of the system, or in certain conditions of the circulating fluid, as in chlorosis, and in anæmia from hemorrhages or other causes; from the passage of the blood, independent of disease of the heart or great vessels.

What is the *character* of these murmurs? They are usually soft, and resemble the blowing of a pair of bellows, ("*bruit de soufflet,*") but sometimes they are harsh and resemble more the sound of sawing or filing, ("*bruit de râpe* and *bruit de scie.*") There is also a continuous murmur somctimes heard by the application of the stethoscope to the side of the neck; it has been called "continuous murmur," "venous murmur," "*bruit de diable.*" &c.

Pericardial Murmurs.

Are the movements of the heart in the pericardium in a healthy condition accompanied by any sound? No.

Under what *circumstances* is sound produced? When the surface of this membrane is inflamed, and thus rendered rough; when solid or semi-solid plastic lymph is effused upon one of its folds, which causes attrition, and a superficial rubbing noise is heard over the pericardial region upon each motion of the heart. This is "pericardial rubbing," "exocardial murmur," or, "*frottement.*"

FUNCTIONAL SIGNS OF DISEASE.

What is meant by the Functional Signs of Disease? They are partly those alterations in the functions that we observe ourselves; and partly the sensations experienced by the patient, and by him communicated to the physician. By them we are assisted in determining the condition of the internal organs.

In what order should these symptoms be examined? First, by

observing the *decubitus* or *position* of the patient; and whether it be equally easy in all situations. The *color* and *appearance* of the *skin* and the *expression* of *countenance* often afford valuable evidence. The *cerebral functions* should be examined. The *intelligence, memory, state of the senses, cutaneous sensibility, functions of motility*, and the *strength*, furnish signs of disorder of this function, whether from functional or organic defect. The condition of the *circulation* should be closely examined in reference to the condition of the pulse, &c.

The *deglutition* may furnish valuable signs. The various *functional derangements* of the *thorax* should be closely examined if they exist.

The symptoms connected with the *organs of digestion* are very numerous, important, and require an examination of the greater part of the alimentary tube. Under this head, the state of the *tongue* and *adjacent membranes* should be examined.

The *secretions of the kidneys* should be attended to, and chemical tests used if necessary.

Chemical tests may also be used in examining other secretions.

Fever.

What are considered to be the essential *symptoms* of fever? A quick and frequent pulse, preternatural heat of the surface of the body, with a sense of chilliness at the commencement, are the most common symptoms of that condition we term fever.

How is fever *divided* by pathologists? Into *idiopathic* and *symptomatic;* or *primary* and *secondary.*

What is understood by *idiopathic* fever? It is where the fever does not depend upon a local fixed inflammation or irritation, but is produced and sustained by causes producing a general morbid state of the system.

What is understood by *symptomatic* fever? It is where the fever is produced and kept up by a primary local inflammation or irritation.

What are the *causes* of fevers? They are divided into the *predisposing* and *exciting.*

The former are those external and internal causes which tend to lessen the powers of the system to resist morbific agents, from the existence of some functional or organic defect.

The latter are those which excite fever by deleterious impressions made on the system, and are checked perspiration, worms, atmospheric temperature, miasmata, noxious gases, heat, cold, electricity, humidity, mechanical injuries, and the various contagions.

What is understood by *miasmata?* It is a morbific agent which acts through the medium of the atmosphere, and eludes our most delicate chemical tests; but known from its effects on the human system.

What are the conditions necessary for its production? The presence of vegetable or animal matter in a partial state of decomposition; moisture and a certain degree of heat, say 80° or thereabouts.

How is miasmata *divided?* Into *koino-miasmata*, and *idio-miasmata.*

What is *koino-miasmata?* It is the product of the decomposition of marshes, and public filth of cities, called commonly *marsh-miasmata*, or *malaria.*

What is *idio-miasmata?* It is the product of the decomposition of the exhalations and secretions of the human body, accumulated and confined in ill-ventilated habitations.

What is understood by *contagion?* It is a deleterious agent, the product of secretion of the animal body in a state of disease, which, when applied to a healthy individual, either by direct contact or through the medium of the atmosphere, produces a disease specifically similar to the one from which it derives its origin.

Infection is a synonymous term, although it has sometimes been applied to cases of contagion communicated through the medium of the atmosphere.

What is understood by *epidemic?* Disease which attacks at the same time a number of individuals, and dependent upon the condition of the atmosphere, of which we are not well informed.

What is understood by *endemic?* Endemic diseases are those confined to a particular situation or locality. Ague is endemic to marshy countries, as an example.

What is understood by *sporadic?* Diseases which come on indifferently in every season and situation, from accidental causes, and independently of any epidemic or contagious influence.

What constitutes a *course* of fever? It is the series of pheno-

mena which intervene between its commencement and termination in convalescence.

How is the course of fever *divided?* Into *intermitting*, *remitting*, and *continued;* according as its phenomena intermit, remit, or are continuous.

What are *stages* of a course of fever? They are the forming, cold, hot, critical, declining, and convalescing.

What are the symptoms of the *forming stage?* Loss of appetite, disturbed sleep, yawning, stretching, wandering pains, an unpleasant sensation at the stomach, a general feeling of *malaise,* nausea, &c.

What are the *symptoms* of the *cold stage?* A sensation of chilliness; a pale, contracted, and dry state of the surface; the volume of the body is diminished, the respiration is confined, irregular, anxious, and oppressed; frequently with a short dry cough, dry tongue, thirst; pulse small, frequent, and feeble, with nausea and vomiting.

What are the *symptoms* of the *hot stage?* Augmented heat, fulness, and reddish color of the surface; flushed countenance, pulse full, quick, frequent, and vigorous; or small, tense, quick, and frequent; throbbing in the head, eyes prominent, and sensible to the light; skin dry and hot; urine scanty, high-colored, &c.

What is meant by *crisis?* It is that period at which the disease has arrived at the highest point, and either a favorable or fatal issue takes place; it is generally attended with some evacuation, as sweating, or increased flow of urine.

What is meant by the *revolution of a fever?* It is the space of time occupied by one paroxysm of fever and its succeeding intermission; or the time which intervenes between the regular periodical exacerbation of fevers not paroxysmal.

What is the *form* which a fever assumes in respect to its revolution called? Its *type*.

Intermittent Fevers.

What are the *types* of intermittent fever? They are the *quotidian*, when the period of revolution is 24 hours; *tertian*, when it is 48 hours; *quartan*, when it is 72 hours; and *guintan*, when it is 96 hours.

What are the periods of a paroxysm of intermittent fever? There are three; the *cold*, *hot*, and *sweating*.

What are the *varieties* of intermittent fever? They are the *inflammatory*, the *congestive*, the *gastric*, and the *malignant*.

What time of year does the *inflammatory variety* occur? Most frequently during the winter and spring.

What is the most frequent *type*? The quotidian.

What are the *symptoms*? In the hot stage, the heat of surface is intense, and the pulse is peculiarly strong, hard, and full. The most characteristic mark of this variety is the want of a complete apyrexia between the paroxysms; the febrile symptoms continuing.

In what class of persons do *congestive intermittents* occur? In persons of exhausted or debilitated habits.

What are the *symptoms*? The cold stage is protracted; there is deep-seated pain in the head, vertigo, fainting; sense of weight or oppression in the breast; coma; a small, weak pulse. Hot stage comes on slowly and imperfectly, the breathing is confined and anxious, with an internal sensation of heat.

What are the *symptoms* of *gastric intermittents*? There are prominent symptoms of gastric and intestinal irritation, redundancy of biliary secretion, and other saburral matters lodged in the intestinal canal. They generally occur in autumn, and are attended with a foul and bitter tongue, much nausea, and bilious vomiting, an icteric hue of the skin, a sensation of weight in the right hypochondrium, and frequently with visceral disorders.

What are the *symptoms* of *malignant intermittents*? A copious and fetid perspiration, colliquative hemorrhages, petechiæ, and other symptoms of malignancy.

What is understood by *masked agues*? It is where other affections, such as neuralgia, sciatica, hemicrania, dysentery, cholera, &c., occur in a strictly periodical manner; like intermittents.

What is the most frequent *cause* of intermittents? Koino-miasmata.

What is the *treatment*? It is divided into that proper during the paroxysm, and that which is to be employed during the intermission. Treatment is seldom necessary during the paroxysm in the intermittents of our climate. If the cold stage is protracted, or there is much congestion, it may become necessary to administer stimulants, and apply revulsives to the extremities. Bland warm

drinks may also be given to allay thirst. During the hot stage, it may be necessary to moderate excitement, and hasten the sweating stage by bleeding, diaphoretics, &c. We may anticipate the treatment proper during the intermission in this stage, by combining our diaphoretics with mercurials. Where the determination to the brain is alleviated if it exist, Dover's powders and calomel answer remarkably well, tending to produce sleep, and promote the sweating stage. In the intermission, mercurial cathartics will be proper, unless mercury has been combined with the diaphoretics during the hot and sweating stage: in which case jalap, castor oil, &c., will answer. Emetics may also be administered if indicated. Whenever the stomach and bowels, and secretions of the liver, indicate a more healthy action, and the intermission is pretty well established by the reduction of inflammatory action, we should administer cinchona, or its active preparations, with or without opium, which in many cases is a useful adjuvant, with a view of breaking up the paroxysms.

In the congestive form, it may be necessary to administer quinine, and other febrifuge tonics, before we can have time to prepare the system by cathartics, &c. Other remedies may also be used, among which arsenic stands prominent; and it is thought by some that, when the paroxysms are broken up by arsenic, they are less liable to recur.

When visceral obstructions, and other sequelæ occur, they should receive their appropriate treatment.

Remittent Fever.

Is there any essential or radical difference between *remittent* and *intermittent* fever? There is not; but from their running a different course, a modification of treatment becomes necessary.

What are the *symptoms?* Languor, drowsiness, pains in the head and back, slight chills, anorexia, tongue covered with a brownish fur, nausea, skin dry and hot, thirst, and the pulse is irritated. The febrile excitement abates, but not so as to amount to a state of apyrexia; this remission lasts a short time; the febrile excitement again arises until it acquires its former violence, or exceeds it, which, after a certain period, again abates, and forms the remission. The grade of violence of these exacerbations varies much in different cases, and different latitudes.

What are the *indications* to be fulfilled in the *treatment?* They are to moderate febrile reaction; to remove from the alimentary canal vitiated and irritating secretions; to remove gastro-intestinal irritation, and restore the healthy functions of the liver and alimentary canal.

How may these indications be fulfilled? The first by blood-letting, in many instances, cathartics, diaphoretics, cold applications, and revulsives.

Cathartics to the extent indicated may fulfil the second

And the mercurial preparations, cupping, blisters, &c., are of essential service in the third indication When the system is properly prepared, quinine given during the remissions will often break up the paroxysms, and it may frequently be combined with diaphoretics, particularly with the sweet spirits of nitre, and given when the febrile symptoms would preclude its use alone.

Hectic Fever.

What are the *symptoms?* It is remittent; rarely if ever idiopathic, but depends upon some local irritation with an exhausting discharge; great debility; weak, quick, and hard pulse; hurried respiration on exertion; heat of skin; evening exacerbations, preceded by a chill, which terminâtes in sweating, more or less profuse; bowels, at first costive, become relaxed, and *colliquative* diarrhœa supervenes; urine generally pale, and without deposit; but occasionally high-colored, and deposits a sediment. The cheeks have a "hectic flush," with general pallor of the surface and great emaciation.

Eyes sunken, but brilliant and expressive; œdema of legs; and disturbed sleep.

What is the *treatment?* That which may be proper for the local difficulty upon which the fever depends. Tonics, dietic and medicinal, and attention to complications which may arise. Astringent and mineral acids are often useful, and also anodyne and soothing remedies.

Yellow Fever.

How is yellow fever *divided?* Into *inflammatory, adynamic,* and *congestive* or *malignant.*

What are the *symptoms?* As premonitory, generally there is depressed mental energy, low spirits, slight chills, nausea, pain in the loins and back, giddiness, &c. In the regular attack, there is occasionally shivering, but generally the premonitory symptoms are succeeded by great excitement, severe pains, and cramp. The eye is swelled, dejected, moistened with tears; and has a dull, heavy, drunken appearance.

The skin is flushed, dry, and hot; the pulse is accelerated, and generally full, soft, and compressible; the bowels are variable; the respiration is hurried, usually nervous, and attended with sighing.

This state of excitement is followed sooner or later by collapse, and yellow hue of the skin and conjunctiva; and black vomit.

The symptoms vary very much in different cases, however.

What are the *indications* in the treatment? To subdue the inflammatory and irritated condition of the system, both local and general; to prevent the state of collapse; and when the inflammatory state of the system is subdued, to sustain the powers of the system.

Continued Fever.

What is continued fever? It is a fever without intermission; and when remission exists, it is scarcely perceptible, and of very short duration.

How is continued fever divided? Into *synocha*, *synochus*, and *typhous.*

What is understood by *synocha?* It embraces all those fevers which are violently inflammatory.

What are its *symptoms?* There is hardness, quickness, and tension of the pulse.

What is understood by *synochus?* It is a grade of fever beginning with synocha, and ending in typhous; and occurs more frequently than any other in the intermittents and remittents of our climate. It indicates a grade of excitement, and not a distinct disease.

What is understood by *typhous?* There is a lower grade of fever, and a proneness to sink.

What are its *symptoms?* A small, weak, quick, and frequent pulse; with great disturbance of the sensorial powers.

Typhoid Fever.

What other name is sometimes given to typhoid fever? *Dothinenteritis.*

What are the *symptoms*? In the *first stage*, there is prostration more than proportionate to the local symptoms, dulness of intellect, cephalalgia, wandering pains in the back and limbs, dizziness, sometimes epistaxis, diarrhœa in about half the cases, anorexia, chilliness, and irregular fever.

In the *second stage*, there is an increase of the cerebral symptoms, dulness of hearing, tinnitus, often delirium; increase of fever, dryness of the skin, diarrhœa; pains in the abdomen with tenderness, especially at epigastrium and right and left iliac regions; tympanitis, enlargement of the spleen, anorexia, eruption of rose-colored papulæ on the abdomen and thorax, sudamina, cough, and sibilant rhonchus.

When the prognosis is favorable, the *third stage* is characterized by the symptoms of the second stage, with a gradual diminution about the end of the second week, and convalescence at the end of the third. If unfavorable, there are sordes on the teeth, stupor, coma, muttering delirium, great prostration; diarrhœa increased at times, with discharges of blood, and rigors.

What is the *pathological anatomy* of this disease? There is a thickening and secretion of whitish matter into the glands of Peyer, and their sub-mucous tissue. The mesenteric glands are enlarged, and the spleen softened slightly. In the *second stage*, there is increased alteration of the glands of Peyer, as well as injection and commencement of ulceration in the adjoining mucous tissue; softening and thickening of the mesenteric glands and spleen. Sometimes there is an inflamed state of the bronchial muccous membrane, gastritis, and softening of the mucous membrane of the large intestine. There is also usually injection of the membranes of the brain or effusion of serum, but never sufficient to explain the violence of the cerebral symptoms. In the *third stage*, the glands of Peyer are ulcerated; the ulcers have irregular excavated edges; sometimes the ulcers are preceded by distinct yellow sloughs in the second and third stages; the mucous membrane around them is reddened, but not much altered in consist-

ence. The mesenteric glands are softened, reddened, and often infiltrated with purulent matter. Pneumonia is often present.

Can typhoid fever be cut short abruptly by *treatment?* No; the main object of treatment is to prevent or remove local inflammations, which cause the greatest uneasiness to the patient, and are often the immediate cause of death.

What is the *treatment?* In mild cases, but little should be done. A small bleeding, with diluents, acids, and neutral and effervescing draughts, are generally all that is required.

When there are symptoms of cerebral determinations, cups, leeches, or cold applications, will be useful; if diarrhœa, opiate enemata will be proper. If pneumonia attend, cupping and leeching the chest will be proper. In the latter stages, the sulphate of quinine and nutritious diet will be proper if the powers of the system fail. If the secretions from the bowels are much altered, mild cathartics will be proper, with which the bowels should be kept open if necessary.

What are the *complications?* There may be perforation of the intestine and its consequences. Undue determinations to the various organs. Tuberculous disease in the last stage. When epidemic, it is very violent, and appears to be sometimes contagious.

These various complications and circumstances require corresponding modifications of treatment.

Typhus Fever.

In what prominent particulars does typhus differ from typhoid fever? It is usually epidemic, manifestly contagious; the pains in the head, back, and limbs more severe; the *lesions* after death more variable; and no constant alterations as in typhoid fever.

What are the *symptoms?* In addition to the above symptoms, there is occasionally epistaxis; nervous symptoms, with profound stupor; dull suffusion of the eyes; petechial eruption (of a purplish tint in severe cases), towards the end of the first week, extending nearly over the whole body, neither so bright nor prominent as in dothinenteritis. Sudamina are sometimes present, although not so frequently as in typhoid fever; pulse frequent and commonly soft; cough with mucus and subcrepitant rhonchus in

the lungs, with feeble respiration; percussion often dull at the same part from congestion; and a change is generally found in the appearance of the blood after death, with frequently a softened state of the solids.

What is the *treatment?* There is no *specific* treatment; the symptoms should be watched, and local congestions and determinations obviated by appropriate treatment, and by this means we can usually mitigate the severity of the attack. Sponging with chloride of soda in solution, and the use of cool acidulated drinks, are beneficial. When the fever declines, tonics and wine are proper, or when there is great prostration. Gentle purgatives are called for; and the saline diaphoretics are useful, especially the acetate of ammonia.

Inflammation of the Alimentary Canal and Accessory Organs.

Inflammation of the Mouth, or Stomatitis.

What are the different *varieties* of this disease?

1. *Common Diffused Inflammation.* Designated as *erythematous* when superficial; but it sometimes extends to surrounding parts. Blisters and ulcerations often occur, and occasionally gangrene; there is often a copious flow of saliva, and the gums sometimes swell and ulcerate about the neck of the teeth.

The *causes* are various; the direct action of irritants, chemical or mechanical; sometimes depends upon the state of the stomach, and also from a general febrile condition.

In the *treatment* of this form, little is usually required. If severe, leeches about the jaw may be necessary; demulcent applications are often beneficial, together with saline cathartics. When advanced, astringent washes are useful, and if sloughing or fetid ulcerations exist, a wash of chloride of soda or creasote is beneficial.

2. *Diffused Inflammation with Curdy Exudation.—Thrush.—Infantile Sore Mouth.* This form may occur at all ages, but most common in early infancy. A superficial inflammation occurs, upon which small whitish points show themselves, and extend; this exudation falls off, and is renewed repeatedly; the mouth is

hot; often there is diarrhœa, and the stools green, slimy, and irritative, with an acid smell. Some fever usually attends; there is not commonly much danger, but in children of bad habit of body may be fatal. It is often connected with some other disease which may be the cause of death. Relapses are frequent. It sometimes extends over the whole interior mucous surface, and has been ascribed to a cryptogamons vegetation, by M. Gruby.

Causes are not always apparent; bnt whatever deteriorates the general vigor, or produces acidity of stomach, may be a cause. It is sometimes epidemic, but there is no reason to consider it contagious.

What is the *treatment?* Correct any disordered condition of the bowels that may occur; use tonics if there is great debility; use a plain diet; demulcent applications; and irritants should be avoided. Two parts of powdered loaf sugar to one of borax, placed in the mouth, is the best local application. Astringents, as alum, nitrate of silver, &c., have also been highly recommended.

3. *Follicular Inflammation*, or an inflamed state of the mucous follicles, sometimes called *aphthæ*.

4. *Eruptive or Vesicular Inflammation.—Aphthæ.* Commences with a distinct vesicle, which soon bursts and leaves a whitish ulcer, with an inflamed circle round it. There is not usually much constitutional disorder.

What is the *treatment?* No general treatment is required in ordinary cases; correct acidity of the stomach, if it exist; regulate the bowels; use emollient and astringent washes.

5. *Ulcerative Inflammation.—Canker.* This occurs on the gums or inside of the cheeks, and when first noticed it is in the form of an ulcer with swelling of the cheek, which is red and shining; there is a copious flow of saliva, with an offensive breath, but different from gangrene. This form, if properly treated, does not penetrate the cheek, or present any serious condition.

Causes are obscure; it generally occurs among the poor, and those having a deficiency of good air, food, &c., in children from two to six years of age, although children differently situated are not exempt.

What is the *treatment?* In the commencement, a cathartic of calomel and rhubarb or oil. Keep the bowels in proper condition;

use plain, farinaceous diet, and tonics of mineral acids and sulph. quinia or bark, in infusion.

Locally, use sulph. zinc in solution (℈j to f ℥j), applied three or four times a day to the ulcer, with a camel's-hair pencil; sulph. of copper and nitrate of silver have also been recommended.

6. *Sore mouth of Nursing Women.* This form is peculiar to women while suckling or in advanced pregnancy. There is loss of taste, and a scalding sensation; ulcers, with elevated borders, painful and inflamed, often occur. The surface is red, tender, and painful, and there is a copious flow of saliva. At first it is local, but if it continues, it extends to the œsophagus, and the stomach and bowels become irritated, and diarrhœa and emaciation take place.

It is *caused* by an influence produced by nursing, and is removed by weaning the child. It is more prevalent in some localities than in others.

What is the *treatment?* Tonics and laxatives in combination; with a diet of milk and farinaceous substances. Locally, astringent infusions, or a solution of nitrate of silver, are recommended. If this course fail, remove the child from the breast.

7. *Gangrenous Inflammation.—Gangræna Oris.—Sloughing Phagedæna of the Mouth.—Necrosis Infantilis.—Cancrum Oris.* This is a peculiar form of disease; and it may be considered as uncertain whether it has any dependence upon inflammation; and is believed by many to be an original affection. It occurs between the periods of the first and second dentition.

It first attracts notice as a whitish, ash-colored eschar, situated on the gums, between the lower incisors mostly, but may occur in any other part; sometimes preceded by inflammatory redness, but not generally. When it occurs on the inside of the cheek, it swells, and the exterior surface looks whiter than in health. Seldom at this stage any fever, pain, or constitutional disturbance. In its progress, the saliva flows, the breath becomes fetid, the bony structure becomes involved, the teeth are loosened and fall out, together with portions of the bony socket. An acrid fluid then escapes, which excoriates and gives cause for a new point of mortification. The slough spreads until it appears externally in the form of an ash-colored spot, which becomes livid or black, and spreads rapidly, involving much of the cheek together with the

upper jaw, provided death does not take place sooner. As it progresses, constitutional symptoms and fever set in, with a feeble pulse, and frequently an exhausting diarrhœa. It occurs mostly among feeble, debilitated children, with insufficient food, bad air, &c. Mercury is seldom, if ever, the cause of this disease.

What is the proper *treatment?* To be of advantage, it should commence early, and consists mostly of remedies calculated to support the strength, as sulph. quinine, Peruvian bark, mineral acids, and nutritious diet; also wine whey, carb. ammonia, camphor, &c. The bowels should be kept open, and opium given to allay restlessness. Local measures are very important; escharotics, early applied to the ulcer, are important; sulph. copper in solution (ʒss to f℥j), applied two or three times a day, so as to come in contact with every part of the surface, is valuable. Solid nitrate of silver, or a strong solution also, if sloughs have formed; mineral acids and undiluted chloride of iron in tincture are recommended as topical remedies. Sulph. zinc in solution (ʒss to f℥j); tr. myrrh; and solution of chloride of soda, or of creasote, to correct fetor, are advised. When a gangrenous spot appears externally, a carrot and charcoal poultice should be applied, and the parts washed with an aqueous solution of creasote.

8. *Mercurial Inflammation of the Mouth.—Mercurial Stomatitis.* What are the *symptoms?* The first are a metallic taste and an increase of saliva; swelling of the gums, then soreness, particularly when the teeth are pressed together; stiffness of the jaws; swelling of gums increases.

GLOSSITIS.

What is glossitis? Inflammation of the tongue.

What are the *symptoms?* A burning and throbbing pain in the tongue, with a synochal grade of fever. The tongue becomes hot, dry, red, swollen, and with a sense of impending suffocation. It terminates sometimes in suppuration, and occasionally in mortification of a portion of it.

What is the *treatment?* Bloodletting, decisively practised, leeches to the lower jaw and tongue, incisions into the substance

of the tongue along its middle, and blisters to the back of the neck. Tracheotomy may also become necessary.

Of Tonsillitis, or Quinsy.

What is tonsillitis, and what are the *symptoms?* It is an inflammation of the tonsils. It is known by slight chills, succeeded by a high grade of fever, and more or less pain in the fauces on swallowing. In a short time, the pain becomes fixed, deglutition nearly or quite impossible, and one or both tonsils much swollen. The face is tumid and red, the carotids beat violently, and the respiration is difficult. It generally terminates either in resolution or suppuration. It is caused mostly by cold and damp air, or suddenly checked perspiration.

What is the *treatment?* Vigorous antiphlogistic treatment should be adopted by general and local bloodletting, scarification of the tonsils, purgatives, and antiphlogistic diaphoretics.

When suppuration takes place, it should be opened.

Parotitis, or Mumps.

What is parotitis, and its *symptoms?* It is an inflammation of the parotid gland, known by slight febrile symptoms, a feeling of stiffness in the jaws, and swelling and pain in one or both parotids.

What is the *treatment?* Keep the bowels open, and use mild diaphoretics. The parts should be kept warm, and avoid taking cold. If the inflammatory symptoms are violent, the antiphlogistic course should be adopted. Should the testicles become affected, a blister should be put on the parotids.

Of Acute Gastritis.

What is gastritis, and what are the *symptoms?* It is an inflammation of the mucous membrane of the stomach, attended mostly with vomiting, and a burning, lancinating pain in the stomach. There is a desire for cool drinks, and an aversion to warm, which aggravate the complaint. The pulse is small, tense, and quick; the pain is constant except for a moment after taking a cold

drink; the patient generally lies on his back, and moves as little as possible.

What are the *causes?* Cold water rapidly swallowed, irritating and corrosive substances, fatiguing exercise, over-distension, improper food, metastasis of gout or rheumatism, injuries, and miasm of some kinds.

What is the *treatment?* Bleeding, general and local, blisters over the stomach, mild mucilaginous drinks, weak lemonade or orangeade, laxative enemata, and, after the phlogistic state of the system has been moderated, opium is beneficial in allaying the pain and vomiting. In convalescence, great care is required in avoiding improper food.

Chronic Gastrits.

What are the *symptoms?* They are very similar to the acute form, only less violent and long continued, with disordered action of all the functions of the stomach.

What is the *treatment?* It may be treated on the same general principles as the *Acute.*

Acute Enteritis.

What is it, and what are the *symptoms?* It is an acute inflammation of the alimentary canal, affecting the peritoneal and muscular coats, or mucous membrane.

What are the symptoms when the peritoneal coat is inflamed? An aching or burning pain about the umbilicus, obstinate constipation, unless the inflammation extends to the mucous membrane, in which case dysenteric discharges take place; nausea and vomiting, dry tongue, urgent thirst, and hot skin. The patient lies on his back with the knees drawn up, and shoulders elevated, with a tumid abdomen from flatus. Its course is rapid, and prone to terminate in gangrene, in which event the pain subsides suddenly, the pulse sinks, the countenance becomes pale, the extremities cold, slight delirium, and sometimes convulsions attend. It generally terminates either in resolution or death, by the eighth day. It is distinguished from pleuritis and hepatitis by a contracted, corded, quick, tense, and frequent pulse, and by the regu-

lar and strong action of the thoracic respiratory muscles; neither of which exists in the other affections. It may be regarded as a dangerous disease.

What are the *causes?* Indurated feces, spasm, injuries, purgatives, hernia, cold, metastasis, &c.

What is the *treatment?* Prompt blood-letting, leeching, mild purgatives, opium in the advanced stages, blisters, and mild mucilaginous diluents.

What are the symptoms when the mucous coat is inflamed? When the small intestines are affected, there is some pain in the umbilical region, more or less nausea and vomiting, and the pulse is corded; the tongue is white or of a light brown; the bowels are loose or easily moved.

What is it called when the colon and rectum are the seat of the inflammation? Dysentery.

Dysentery.

What are the *symptoms?* It is often ushered in by the ordinary symptoms of remittent fever, pain in the bowels, costiveness, or diarrhœa, followed by frequent mucous and bloody stools, tormina, and tenesmus, with a retention of the natural feces. Tenesmus is one of the most constant and characteristic symptoms of this disease. The violence of the symptoms is a pretty good criterion of the danger of the disease. It is an inflammation of the colon and rectum essentially.

What are the *causes?* Atmospheric vicissitudes, and koino-*miasmata.*

What is the *prognosis* when the discharges consist almost entirely of blood at the commencement? More favorable than when composed of mucus tinged with blood.

What is the *treatment?* The indications are to moderate the excessive reaction of the heart and arteries, to restore the healthy action of the liver and skin, and to subdue the local inflammation of the bowels.

Whenever the pulse is firm and quick, or tense and frequent, blood may be drawn. Purgatives judiciously managed are beneficial; castor oil and calomel are among the best. Diaphoretics, as Dover's powder combined with calomel, and followed by a

laxative, are beneficial. Opium, sugar of lead, blisters, and anodyne enemata, are all beneficial in their proper place.

Chronic Enteritis.

What are the *symptoms?* There is pain, and a sense of soreness felt on coughing or sneezing, languor, and weakness; the pulse is small, weak, and sharp, or corded; the hands and feet cold, flushed cheeks, and a burning in the palms and soles; pain after eating, diarrhœa, digestion is imperfect, and there is tormina. The discharges are slimy and bloody, or watery and profuse, and there is emaciation.

What are the *causes?* It may be a consequence of the acute form, but it much more frequently results from crude, indigestible food, and other irritants applied to the bowels, or from atmospheric vicissitudes.

What is the *treatment?* Regulation of the diet is important and indispensable. Farinaceous diet, such as arrowroot, oatmeal, barley, tapioca, rice, and sago, should be used; animal food and solids are generally inadmissible. Mild laxatives are to be used carefully. Leeches applied to the abdomen are also useful. Emulsions of copaiva, spirits of turpentine, and mucilaginous drinks, may be used.

Acute Peritonitis.

What are the *symptoms?* It is ushered in by chills, pains in the limbs, &c. There is pain in the abdomen, and in all cases external pressure on the surface of the abdomen is very painful. The patient lies on the back with his feet drawn up, and shoulders elevated.

What are the *causes?* Mechanical injuries, violent exertions, perforation of the stomach and its consequences, parturition, metastasis, &c.

What is the *treatment?* The most important measure is decisive bloodletting, general and local; with the application of poultices, and revulsives.

Purgatives, of which a good one is castor oil, combined with spirits of turpentine, are beneficial. Large doses of opium alone or combined with calomel are also employed.

ACUTE HEPATITIS.

What are the *symptoms?* Pain in the right hypochondrium, a sensation of tightness across the abdomen, difficult respiration, the body inclined forwards, the pain extending to the clavicle and shoulder of the right and left side. — Pressure over the liver, and an attempt to lie on the left side, produce pain. There are general febrile symptoms, costiveness, and a scalding in passing urine.

What are the *causes?* Miasm, atmospheric vicissitudes, injuries, metastasis, &c.

What is the *treatment?* Bloodletting, general and local, mercurial cathartics, antimonials, diaphoretics, cupping, blisters, and nitro-muriatic acid.

CHRONIC HEPATITIS.

What are the *symptoms?* When it is not the consequence of an acute attack, it begins with disorders of the digestive functions; there are pain and tenderness over the region of the liver, and a dry, harsh, constricted state of the skin.

What is the *treatment?* Sometimes leeches are proper, and mercury is considered indispensable. Nitro-muriatic acid, blisters or other revulsives, and low diet, are beneficial.

ORGANIC DISEASES OF THE LIVER, NOT NECESSARILY DEPENDENT ON INFLAMMATION.

What are their general *characteristics?* There are several affections of this kind, and it is often difficult to distinguish them from chronic inflammation, and they are mostly complicated with this condition in some of their stages. There is a deranged state of the stomach and intestines, frequently a jaundiced color of the skin, eyes, and secretions, heaviness, dulness, stupor, and mental depression, followed by dropsical effusion. The liver is also often enlarged and tender on pressure.

What are the various forms of these derangements? *Hypertrophy*, or enlargement of the proper structure of the liver affecting the whole or a portion of it. There is no symptom during life to distinguish it positively from other enlargements of the liver.

Atrophy is the reverse of the preceding. An accurate diagnosis is not possible during life.

Induration produces greater firmness and hardness than in health, and may arise without other change, and also from depositions or new formations. The bulk may be increased or diminished, and it is not distinguishable from hardness proceeding from other causes.

Softening is frequently produced by inflammatory action, but not always. It varies in degree and character very much in different cases.

Cirrhosis, or *granular degeneration*, consists in the development of numerous corpuscles or granules varying in size from a pin's head to a hazel-nut. The organ is lessened in size, and becomes harder and denser. The color of the corpuscles varies from a yellowish to a brownish or reddish hue. The symptoms are not well marked, so as to distinguish this disease with certainty. It seems to be an incurable disease, so far as we can judge.

Fatty Liver. — In this form of disease, the liver is usually increased in size, and sometimes very much. The hue characterizing it is of a pale yellow or cream color, with brownish or reddish spots, but when cut into it is less variegated than the surface, has an unctuous feel, greases the knife, makes a greasy stain on bibulous paper, furnishes oily matter when heated, and the proper substance is atrophied.

We have no means of diagnosticating this disease with accuracy. It is often found in phthisis.

Tubercles are sometimes found in the liver of the same character as those found in the lungs in phthisis.

Serous Cyst and *Hydatids* have frequently been found in the liver, of various sizes.

Malignant Affections are often found as secondary affections, and sometimes as primary. They form tumors of greater or less prominence, and may commence at a single or at numerous points. Inflammation is generally produced, and the diagnosis is difficult.

The general *treatment* for these affections is that proper for chronic hepatitis, and such special attention as the peculiarities presented may require.

Of Inflammation of the Nervous System.

Cephalitis.

What are its *varieties?* They are *meningitis* and *cerebitis.*

How is meningitis *divided?* Into *phrenitis*, when there is inflammation of the pia mater; and *arachnitis*, when the arachnoid membrane is affected.

Phrenitis, or Phrensy.

What are the *symptoms* of phrenitis? A sense of fullness in the head, generally nausea or vomiting, pain and febrile reaction increase, the eyes become flushed and sparkling, and delirium ensues. The pulse is firm and active with a disturbed respiration.

What are the *causes?* It is seldom idiopathic but commonly occurs during the progress of fevers.

Its exciting causes may be violent passions, insolation, the influences of cold, drunkenness, metastasis, &c.

What is the *prognosis?* It is attended with great danger, and this is generally in proportion to the violence and obstinacy of the symptoms.

What is the *treatment?* A vigorous antiphlogistic course is promptly demanded by bloodletting, general and local, ice to the head, purgatives, antimony, nitre, digitalis, &c.

Arachnitis.

What is this commonly called? *Acute dropsy of the brain*, or *acute hydrocephalus.*

At what period of life does it generally occur? During dentition.

What are the *symptoms?* Wakefulness, irritability of temper, repugnance to light, pain in the head, restlessness, and irritated, quick, tense, and active pulse, torpid bowels, retching and vomiting, delirium, dry skin, dilated or contracted pupils, somnolency, coma, strabismus, and paralysis or convulsions.

What are the *post-mortem* appearances? Injection or thickening of the membranes, and an effusion of serum.

What are the *causes?* Hereditary predisposition, blows, falls, insolation, metastasis, dentition, intestinal irritation, and whatever may produce a determination of blood to the brain.

What are the *indications* of treatment? To moderate arterial action, to remove the congested and inflammatory state of the brain, to remove the causes of irritation. To fulfil these, bloodletting general and local, purgatives containing calomel, ice to the head, and blisters, are among the most useful means. The diet should be simple and unirritating.

Cerebritis, or Ramollissement of the Brain.

What are the *symptoms?* It has been divided into two periods, with symptoms peculiar to each. In the *first*, there is fixed and violent pain in the head, which may continue a long time; vertigo, obtuseness and confusion of intellect, loss of memory, and indifference to surrounding objects. The pulse is often full and hard.

In the *second*, there may be gradual or sudden paralysis of one limb or half the body, and difficulty of speech; coma sometimes occurs, followed by convulsions, which leaves a contracted state of the flexor muscles of the limbs, or rigidity, which has been considered as peculiar.

What is the *treatment?* General and local bloodletting, active cathartics, blisters, and mercury.

Of Inflammation of the Respiratory Organs.

Pneumonia.

What is understood by *pneumonia?* It is an inflammation of the substance of the lung.

What are the *characteristic symptoms?* Pain in the chest with fever, accelerated and oppressed breathing, cough, with a viscid and rust-colored expectoration. There is a crepitant rhonchus at first, followed by the bronchial respiration.

How are the stages of pneumonia *divided?* Into four.

What are their *anatomical characters?* In the *first*, there is sanguineous congestion or engorgement of a red appearance, but still it will crepitate.

In the *second*, there is red hepatization, the lung sinks in water, and the color is not uniform, but when torn it exhibits fine granular points, of the size of a pin's head.

In the *third*, there is suppuration or yellow hepatization; this

suppuration is diffused in the form of purulent infiltration, and rarely assumes the form of a distinct abscess.

In the *fourth*, there is gangrene, in which the parenchyma is softened down.

What are the *physical signs* of these stages? In the *first*, there is crepitant rhonchus; as it progresses, there is dulness on percussion, some degree of bronchial respiration, and vocal resonance.

In the *second*, crepitation and vesicular respiration cease, and the only sounds are those produced by the air and voice in the larger tubes, which are very loud, and are bronchial respiration and bronchophony. There is pretty complete flatness on percussion, and the lung does not expand.

In the *third*, the physical sounds are the same, until the effused matter begins to liquefy, and then there is mucous rhonchus.

In the *fourth*, there is added to the signs a putrid fetor in the matter expectorated as well as in the breath, together with subcrepitant and mucous rhonchus, passing into gurgling and pectoriloquy.

What are the *signs* as the inflammation *abates?* The crepitation and resonance return.

What are the *varieties* and *complications* of pneumonia? *Typhoid pneumonia, pneumonia complicated with bronchitis*, and *pleuro-pneumonia.*

What is understood by *typhoid pneumonia?* It is when pneumonia is attended by low adynamic fever from any cause, and the inflammation is rather of a congestive than of an inflammatory character.

What is understood by *pleuro-pneumonia?* It is where pneumonia is complicated with pleurisy, and the symptoms are modified by effusion.

What is the *prognosis* of pneumonia? It is a serious disease; more dangerous the further the disease advances, and the greater its extent and complications.

At what period does death usually occur? About the beginning of the third stage.

What are the *causes?* All causes which tend to produce asphyxia, violent exertion, atmospheric vicissitudes, and exposure, diseases of the heart, bronchitis, wounds, tubercles and foreign bodies.

What is the *treatment?* In the *first* stage, bloodletting, general and local, repeated if necessary; tartar emetic, mercury and opium, after bleeding.

In the *second* stage, mercury and opium are appropriate remedies; with external irritation by blisters, and expectorants containing an alkali.

According to the grade of action, we may give digitalis, squill, &c., or senega, camphor, and carbonate of ammonia, as indicated. Hydriodate of potassa with senega or sarsaparilla will hasten absorption in convalescence.

In the *third* stage, antiphlogistics are not to be used, and if remedies are used at all, they should be of a stimulating kind, such as carbonate of ammonia, ether, camphor, senega, wine, &c.

In the *fourth* stage, unless the general symptoms contra-indicate its use, wine, quinine, &c., must be administered.

What is the treatment of the *typhoid pneumonia?* General bloodletting is not admissible; but local may be. Dry cupping, blisters, sinapisms, calomel and opium, with stimulants.

In the other complications, the treatment does not differ much from ordinary cases of pneumonia, and requires a corresponding treatment modified by the state of the general system.

What is the disease commonly termed *bilious pneumonia?* It is simply pneumonia complicated with a deranged condition of the liver.

What kind of pneumonia usually attacks children? *Lobular pneumonia;* the anatomical character of which is diffusion of inflammation through several scattered points at the same time, and usually affects the posterior part of the lung.

What are the *symptoms?* The respiration is rough; there is generally mucous and sub-crepitant rhonchus; the respiration only becomes bronchial at the latter stages of the disease; there is also dulness on percussion.

What is the *treatment?* The position of the child should be changed frequently, and kept in a uniform temperature. Local bleeding in the commencement, counter-irritants, and ipecacuanha internally, are valuable; or, if the child be strong and robust, tartar emetic may be given.

Remedies, to be of use, should be persevered in

Pleurisy or Pleuritis.

What is understood by *pleurisy?* It is an inflammation of the pleura.

What are the *characteristics* of this disease? A sharp pain in the side, diminished resonance of the side, a friction sound, with ægophony, followed by enlargement, and absence of respiration and voice in auscultation. There is always effusion.

How may we classify the products of pleurisy, or the matter which is effused in acute and chronic pleurisy? Into two classes: Those in which absorption predominates over effusion, and the liquid is removed; and those in which the effusion predominates, and the liquid can only be removed through a perforation of the pleura.

What are the signs of *absorption?* The side becomes contracted, and from being larger than the other side becomes smaller. In some cases after a time there may be a weak respiratory murmur, slight resonance on percussion and of the voice.

What is generally the character of the fluid when effusion predominates? It is purulent; and constitutes the empyema of authors.

What are the *signs?* The same as those characteristic of liquid effusion, modified by the length of time that effusion continues. Rigors, hectic fever, &c., may exist; which, when they do, are indicative of a purulent effusion.

What is the *prognosis* in pleurisy? It is dangerous when neglected; but when simple, and remedies are promptly employed before the effusion is copious, it generally yields readily. But when it is complicated with tubercles, or it becomes chronic, it may be fatal.

What are the *indications* in the treatment of pleurisy? To subdue inflammation; to promote the removal of its product; and in chronic cases to improve the state of the general health.

What are the *means* used for these objects? In the *first stage*, full general bleeding to the extent of removing all pain on full respiration, or the hardness of the pulse is subdued; local blood-letting followed by a poultice, or hot, dry napkins, a repetition of the bleeding, if necessary, brisk purgatives containing mercury and

antimony; tartarized antimony alone, and blisters, are useful. Then mercury, digitalis, colchicum, alkalies, &c., will be useful to fulfil the *second indication*, and to still further assist in reducing inflammation. The patient must use light diet, and remain in bed while there are acute symptoms.

To fulfil the *third indication*, when the pulse is weak or the fever hectic, a nutritious and tonic plan must be pursued so far as they are not contra-indicated by other symptoms. Counter-irritation should be used now as well as previously, and the preparations of iodine internally and externally are very useful. Diuretics are also often indicated.

Is the operation of *paracentesis thoracis* advisable? It may be in some cases; for instance, when there is a sudden effusion threatening suffocation, or where there is an old extensive effusion increasing constantly, and showing no disposition to be absorbed; but the propriety of the operation is questionable, except in a very small proportion of cases.

Where should the opening be made? When the abscess points, there is no choice, this must be the part; in other cases, the intercostal spaces between the third and seventh ribs. The fluid should be drawn off at successive times, the orifice closed in the intervals, and the admission of air prevented.

What connection has pleurisy with tubercles? It may be a cause or a mere sign of their presence, and should therefore be closely watched until conducted to a full convalescence.

Laryngitis.

What is laryngitis? An inflammation of the submucous cellular membrane of the larynx.

How is it *divided?* Into *acute* and *chronic.*

Acute Laryngitis.

What are the *varieties?* *Sthenic* and *asthenic.*

What are the *symptoms* of the *sthenic* form? Difficulty of swallowing, with high fever, preceded by rigors, hoarseness, husky convulsive cough, tenderness, pain, and constriction in the larynx; and difficult, prolonged, sonorous inspiration. The fauces are generally red; by pressing the tongue downwards, the epiglottis

may be seen erect, thickened, and of a bright red color. As the disease progresses, the countenance becomes anxious, the lips livid, the eyes staring and watery, the voice reduced to a whisper, and the pulse is reduced and unequal. The patient then becomes enfeebled, delirious, comatose, and dies.

What are the *symptoms* of the *asthenic?* It differs from sthenic in the absence of inflammatory symptoms and fever; and sometimes of pain and difficulty of deglutition.

What are the *causes* of acute laryngitis? Exposure to cold and wet, tonsillitis, swallowing scalding or corrosive liquids, &c.

What are the *anatomical characters?* A red, injected, and thickened state of the lining membrane.

What is the *prognosis?* It is the most fatal of all inflammations.

What is the *treatment?* In the sthenic form a most prompt and energetic antiphlogistic course should be adopted, by bleeding, calomel, and antimony, before effusion takes place.

Salivation should be attempted and brought about as soon as possible. Bronchotomy must be resorted to, if our other remedies fail, and the state of breathing requires it.

In the asthenic form, mercury must also be used, but depletion is not allowable, except locally; blisters and other revulsives may be used. These failing, and other symptoms requiring it, bronchotomy should be resorted to.

Chronic Laryngitis.

What are the *symptoms?* It is more frequent than the acute, exists in various degrees, and is known by hoarseness, a husky, dry cough, with soreness or pain in the larynx on pressure.

What are the *anatomical characters?* Redness and thickening of the mucous membrane, contraction of the ligaments, fibrous degeneration, wasting of the muscles, and ulceration.

What is the *prognosis?* Slight cases are often curable

What are the *indications* of treatment? To subdue chronic inflammation and remove its effects; to relieve urgent symptoms and improve the general health.

The parts should be kept at rest, and protected from dust, cold, air, &c.; leeching, blisters, a mild mercurial course, hydriodate of potassa, and the application of nitrate of silver, sulphate of

copper, &c., either in solution or powder, to the larynx internally, are recommended.

It is often connected with phthisis, either as a cause or complication.

Cynanche Trachealis, Tracheitis, or Croup.

What are the *symptoms?* At first there are catarrhal symptoms, hoarseness, &c.; then stridulous respiration, a rough peculiar barking and ringing cough, with high fever; these symptoms are followed by general failure of the vital powers, with an increase of the unfavorable symptoms, lividity, suffocation, &c. It varies in intensity in different cases.

What are the *anatomical characters?* Redness of the mucous membrane, continuous or in patches; the submucous tissue is swelled, and in advanced stages when there is sthenic action there is an effusion of a gray, white, albuminous matter, forming a *false membrane* having the shape of the trachea.

What are the *causes?* Exposure to cold and damp, and to humid, ill-ventilated places. It occurs from one to six years of age.

What is the *prognosis?* It is a serious disease; and if not quickly arrested by treatment, soon terminates fatally.

What is the *treatment?* The indications are to diminish inflammatory action and its consequences; to procure the discharge of such matters as are produced in the trachea; to subdue spasmodic action; and in the latter stages to support the powers of life.

At the first invasion, an emetic of tartar-emetic or ipecac. is the best remedy; and in slight cases it will cut short the disease, particularly if followed by a warm bath, calomel, James's powder, and castor oil.

If the fever runs high, free bloodletting, soon after the administration of an emetic, which will assist its action; cupping, calomel, tartar-emetic, blisters, &c., are indicated. In the last stages, where collapse has supervened, stimulants and cordials must be used, and antispasmodics in the spasmodic form.

Acute Bronchitis.

How is it *distinguished?* By the terms *sthenic* and *asthenic.*

What are the *symptoms* of the *sthenic* form? Marked in-

flammatory action, pain, constriction across the sternum, severe cough, with glutinous expectoration, high fever, and hurried breathing. The rhonchi are at first sibilant and sonorous, afterwards mucous and submucous, with weakened respiratory murmur, and a clear sound on percussion, showing the vesicular structure free from disease. If not arrested, it may become complicated with inflammation or congestion of the lungs, asphyxia, and death.

What are the *symptoms* in the *asthenic* form? The chief difference is in the symptoms of depression, with gastric derangement, great oppression of breathing, and mucous rhonchus in the early stages. It is almost peculiar to old people, persons in delicate health, and young children.

What are the *causes?* Cold and moisture, variable atmosphere, and eruptive fevers.

What are the *anatomical characters?* A red color and thickening of the mucous membrane, with a frothy or purulent fluid in the bronchiæ.

What is the *prognosis?* It must be determined by the extent and stage of the disease, and the general condition of the patient.

What is the *treatment?* When *sthenic*, bleeding, general and local, according to the condition of the patient, a purgative of calomel, small doses of tartar-emetic, tincture of digitalis, wine of colchicum, &c., will contribute to reduce the inflammation, and hasten its termination by expectoration. Revulsives to the chest are also useful. When there is a free secretion, blisters and stimulating expectorants are proper; and if a state of collapse comes on, we must stimulate actively with carbonate of ammonia, camphor, &c. In the *asthenic* form, depletion cannot be carried to much extent. Leeches, dry cupping, and blisters should be used, with small doses of mercurials and antimonials or ipecac., with a decoction of senega, squills, &c. In young children, emetics and mercurials are useful in bronchitis.

Chronic Bronchitis.

Are acute and chronic inflammations of the air-passages separated by a well-defined line? They are not; the chronic are distinguished, however, by the continued presence of opaque matters

in the expectoration, such as are classed under the head of albuminous.

What are the *symptoms* of chronic bronchitis? Expectoration, varying in different cases; when purulent, there may be hectic and night sweats, like pulmonary consumption, but the physical signs are wanting; the chest expands well, and sounds well on percussion, and there are the various rhonchi which are continually shifting and changing.

What are the *causes?* Repeated attacks of the acute, breathing impure air loaded with irritating particles, &c.

What are the *anatomical characters?* The mucous membrane is of a deep red color generally; sometimes, however, paler than natural, where there has been copious purulent expectoration; ulceration is not a common occurrence unless there has been an habitual inhalation of dust.

What is the *treatment?* Counter-irritants, expectorants, and anodynes, with a close attention to the general symptoms. In those predisposed to this disease, sponging the body with cold water, and vinegar and salt, is useful. The body should also be well protected by a flannel or leather jacket.

Phthisis Pulmonalis, or Pulmonary Consumption.

What form of disease is included under these terms? All diseases of the lungs dependent on tuberculous matter, or depositions and indurations allied to it.

What are its *general characteristics?* Cough, at first with little expectoration, sometimes hæmoptysis; as the disease progresses, the expectoration becomes opaque, purulent, and copious; fever, quick pulse, night sweats, dyspnœa, emaciation, and debility. The principal physical signs are irregular expansion of the chest, dulness on percussion, with more or less bronchial respiration, and bronchophony in the upper parts of the chest, followed by cavernous rhonchus and respiration, and pectoriloquy, which indicate more or less consolidation of the lung, succeeded by cavities communicating with the bronchiæ.

What are the *anatomical characters?* They may be arranged under the following heads:—

1st. The *miliary granulations* or tubercles, which are a number

of little hard bodies of a semi-transparent, reddish drab, or skin color, or sometimes of a gray or ash color, generally in clusters.

2d. A *consolidation* diffused through the pulmonary tissue without particular shape, varying in consistence, sometimes hard, and somewhat semi-transparent, resembling the miliary granulations, but generally darker.

3d. *Opaque yellowish-white masses;* some are nearly solid, and others have a cheesy consistence. Tuberculous matter is frequently found diffused through the pulmonary texture, which is the infiltrated tubercle of Laennec. All these conditions tend to pass into a softened fluid state, form vomicæ, and leave the next form of lesion.

4th. *Cavities* or *excavations*, various in number, form, and size, containing more or less tuberculous matter, liquid pus alone or tinged with blood, mucus, a mixture of all these, or empty. They communicate with the air-tubes, and often with each other; their sides are composed of consolidated lung, rough and sometimes sloughy, or of an irregular coat of lymph; in others thick, rigid, and of a fibro-cartilaginous character. These lesions affect the upper and posterior, more than the anterior lobes, and are often attended with various complications, such as bronchitis, pneumonia, &c.

How is the *course* of consumption divided? Into three stages. The *first* is that of the formation of the indurations, granular or diffused; the *second* is that of the conversion of these into yellow tubercle, and the extension of the lesion; the *third* is that of their softening, evacuation, and the formation of vomicæ.

What are the *symptoms* of the *first* stage? Hacking cough, either dry, or with thin and transparent expectoration; sometimes pains in the chest, quickness of the pulse, with occasional flushes of fever, terminating in perspiration; more or less dulness on percussion, increased bronchophony, and bronchial sound on expiration.

What is the *second?* The symptoms of irritation continue, there is languor, loss of flesh, increased pain, generally chills, fever, and sweating, more abundant expectoration, thicker, and sometimes tinged with blood. The mucous and sub-mucous rhonchi are heard. There are signs of increased density of the lungs, the dulness on

percussion is increased, the respiration becomes more bronchial, and the vocal resonance is increased.

What are the *symptoms* in the *third* stage? The consumptive symptoms of the last are increased, a copious and heterogeneous expectoration of pus, mucus, softened tubercle, blood, shreds of lymph, and sometimes portions of pulmonary tissue; confirmed hectic, occasionally diarrhœa, increasing marasmus, &c. Cavernous rhonchus or gurgling is heard, followed by cavernous respiration and pectoriloquy when the cavity is empty; and when it is very large, the sound is amphoric. The walls of the chest sink and form a hollow below one or both clavicles, and there is a defect or irregularity in the movements of the chest. The expectoration is often *nummular*, or with a defined margin, and flattened like money, from which it derives it name.

Is phthisis a constitutional or a local affection? It is both constitutional and local.

What are the *varieties* of phthisis? They are the *acute* and *chronic*.

What are the *indications* in the treatment of phithisis? To diminish the local irritations and congestions that lead to the formation of indurations or tubercles; to correct the condition of the system which degrades the nutritive process, and disposes to the formation of these diseased products; to promote the removal of those already deposited; and to treat troublesome symptoms and accidental complications.

In the *first* stage, antiphlogistic and counter-irritant remedies avail most; but depletion should be limited to cases in which there is plethora, pulmonary inflammation, congestion, or hemorrhage. Emetics, iodine, sarsaparilla, columbo, digitalis, carbonate of iron, pure air, change of climate, and exercise, are all useful when properly adapted to the particular case, and will sometimes arrest the disease. The diet should be mild and nutritious.

In the *second* and *third* stages, depletions are less needed, and a somewhat tonic plan, with or without counter-irritants, is indicated, with a more generous diet. Mild expectorants and anodynes are often useful and necessary, and of the latter, hyoscyamus answers better than opium or its preparations. Localities protected on their northern and eastern limits, and facing the south, are to be preferred as residences.

What means may be made use of in the *prevention* of phthisis; Prevent or speedily remove those inflammations and congestions which tend to the development of tubercles, and of that state of strumous cachexia or imperfect nutrition from which they arise. Hereditary predisposition is a prominent cause, and may be in some measure prevented by care in forming matrimonial alliances; intermarriage should never take place with families where the predisposition exists.

Attention to residence, food, clothing, exercise, &c., is necessary for persons predisposed. The powers of life should be maintained in as perfect a manner as possible, both by hygienic and remedial means.

Emphysema of the Lungs

What is understood by emphysema? An affection of the lungs, in which the tissue is morbidly distended with air. There are two varieties: *vesicular*, where the dilatation is confined to the air cells; *extra-vesicular*, where the air escapes into the interlobular tissue, or upon the surface of the lung beneath the pleura.

What are the *symptoms?* When very slight, it produces no characteristic symptoms or physical signs. But when more severe, dyspnœa occurs to a greater or less extent, according to circumstances, sometimes very severe, resembling spasmodic asthma; cough and expectoration vary, but there is no fever unless acute inflammation be present; lividity of the lips, indicating imperfect aëration of blood.

The *physical signs* are more evidently diagnostic. There is unusual dilatation of the chest, general or partial; the thorax is more cylindrical than in health, the intercostal spaces are widened, the ribs are more horizontal, and the hollow above and below the clavicle is filled up. The chest over the affected portion of the lungs emits an unusually clear sound on percussion, which is not as in health increased by a full inspiration, while the respiratory murmur is feeble or not heard at all. The history of the case, the presence of liquid effusion, and the metallic sounds in pneumothorax, will serve to distinguish it from this latter affection. Emphysema is a protracted disease, running from childhood to advanced old age, and seldom fatal except by complication, as disease of the heart, &c.

Anything producing and sustaining dysynœa may act as a *cause*.

What is the *treatment?* Rest, and a removal of the immediate exciting cause. Bloodletting, general or local, if there is pulmonary congestion, narcotics, antispasmodics, counter-irritation, and nauseants, for the relief of the paroxysms. All exciting causes should be carefully avoided, so as to prevent the paroxysms, and permit contraction of the dilated vesicles.

Nephritis.

What are the *symptoms?* Slight chills, fever, pain in the loins darting down to the ureters, testicle retracted, the urine in small quantity, tinged with blood, and frequent desire to pass it. Cold is a frequent cause, also blows, strains, &c.

What is the *treatment?* General bleeding, cupping, leeching, purgatives, mucilaginous diluents, sinapisms, hot applications, &c.

Cystitis.

What are the *symptoms?* Violent burning, lancinating or throbbing pain in the region of the bladder, perineum, and sometimes the testicles, with a sense of constriction in the hypogastric region, pain from pressure above the pubes, and strangury.

What is the *treatment?* The same general course as in nephritis.

Bright's Disease.

Synonymes. Granular degeneration of the kidneys.—Albuminuria, albuminous nephritis.

What are the *symptoms?* It is a peculiar disease of the kidney, presenting, however, some variety in its manifestations. Its essential character is a morbid deposit in the substance of the kidney, with an atrophied condition of its glandular structure, albumen in the urine, density of the secretion diminished, blood altered, and dropsical effusion. It may be *acute* or *chronic*, but generally chronic. There is more or less constitutional derangement; and it is generally associated with *dropsy*, sometimes with cardiac and hepatic diseases, inflammation of serous membranes, vomiting, diarrhœa, coma, &c.

What are the *causes?* Anything which deteriorates the energy of the constitution may predispose to this disease, as intemperance, scrofulous disease, scarlatina, &c.; the causes are often obscure, but the most frequent are alcoholic drinks and exposure to cold and moisture.

What is the *treatment?* Remove dropsical accumulations if they are present; avoid mercury, and adapt the treatment to the constitutional and local conditions, which will vary in the acute and chronic forms, and also in different stages of the disease; all causes of the disease should of course be carefully avoided both during treatment and afterwards.

Diabetes.

Synonyme. Diabetes Mellitus.—Honey Diabetes.—Saccharine Diabetes.—Melituria.

What are the *symptoms?* An excessive discharge of saccharine urine, attended with thirst; a clammy state of the mouth and fauces; a coating of frothy mucus or white fur on the tongue; constipated bowels; a dry, harsh skin; a sense of weariness or dull pain in the back, loins, and lower extremities; chilliness, lassitude, weakness, and emaciation. Dyspeptic symptoms supervene, but with a general increase of appetite. As the disease advances, symptoms of a more violent character occur, the discharge of urine increases in quantity, and the craving for food and drink becomes insatiable, although excessively large quantities of both are taken into the stomach; the emaciation continues to increase; the sexual propensity is lost, the temper soured, spirits depressed, and the memory and intelligence impaired, while nutrition and the bodily functions are in a depressed condition.

The urine is of a pale yellow or greenish color, faint sweetish odor, like fresh milk, of a sweetish taste, and enormous in quantity, amounting in many cases to thirty, forty, or fifty pints, and even more; the density is also undiminished or much increased. The urea and salts are not diminished although the relative quantity in the urine is lessened, so that the increased density is from a new ingredient, which is sugar, and of that variety known as *glucose* or *grape sugar.* A good test is to add yeast, which will cause a fermentation with the escape of carbonic acid gas, which will not

take place in healthy urine; if the quantity of carbonic acid be collected, the quantity of sugar may be ascertained, being about one grain for every cubic inch of gas evolved. Other tests are quite as valuable and more accurate, but are much more complicated. The course is usually slow, and liable to much fluctuation in its phenomena.

It has been pretty conclusively proved that the sugar is formed during chymification out of the elements of the food; and thus diverted from their usual course in the formation of the protein compounds for the nourishment of the body, while the presence of sugar in the blood stimulates the kidneys to inordinate action.

The *causes* are obscure, although anything which deranges digestion, depresses the vital functions, excesses and mechanical injury, have been supposed to excite it occasionally.

The *prognosis* is generally unfavorable, and although in the early stages it is occasionally cured, it is very liable to relapses.

What is the *treatment?* The indications are to prevent the formation of saccharine matter; to diminish the amount of the discharge of urine; and to alter the condition of the blood. To accomplish the former, the functions of the stomach must be altered, or the entrance of materials into the system prevented, out of which it can be produced. In the first of these consists the great difficulty. We must restore the gastric energy by the use of bitters and chalybeates where there is no evidence of vascular irritation or inflammation; the bowels should be kept open, although acrid purgatives should be avoided. Emetics have been recommended by some, and the alkalies have had their advocates. Diet should be used least capable of conversion into sugar by the use of one exclusively animal, or in which those substances predominate; when vegetables are used, they should be such as contain little starch or matter capable of being changed into sugar. If these means prove successful, there is no occasion for further treatment; but they are seldom entirely so, and it becomes necessary to resort to means to diminish the discharges. For this purpose the drinks should be regulated and lessened, and diaphoretics containing opium administered, so as to allay nervous irritation and determine to the surface.

Astringents and terebinthinates have also been used to advantage when there is a relaxed condition of the kidney. To improve

the general condition of the system and of the blood, resort has been had to bleeding, followed by tonics, such as quinia, iron, &c. Complications which may arise should be treated according to circumstances. Even in cases where an apparent cure has been performed, great caution in regard to diet, exposures, &c., should be observed for a long time.

Lithiasis.

Syn.—Gravel.—Calculous Disease. What is understood by lithiasis? It is a disease characterized by a deposit from the urine within the body of insoluble matter, and may take place in various forms. The chemical nature also of the deposit varies in different cases, and may be arranged under the following heads: 1. *Uric acid*, or *the urates;* 2. *The phosphates;* and 3. *The oxalate of lime.* The *first* of these is the most common, and the deposit is like brick-dust, and termed *lateritious.* It may usually be relieved when in the form of gravel. The *second* is much less frequent; the deposits are generally the double phosphate of magnesia and ammonia, and the phosphate of lime, either separate or mingled. These deposits are distinguished by their white color; insolubility in a solution of potash; and solubility in dilute muriatic and acetic acids. The *third* does not usually come under the notice of the physician until symptoms of calculus are presented. The urine is generally clear, and little if any sediment is deposited. If any amorphous or crystalline concretions are found, and prove to be insoluble in acetic acid, and solution of potassa, and soluble in dilute nitric acid, we may know that the deposit is the oxalate of lime; or if there be transparent octohedral crystals found in the urine on examination of the microscope.

What is the *treatment?* The object is to prevent the deposit, and to remove any that may have taken place, and the means vary in the different forms of this affection. In the first, or *uric acid* variety, the alkalies and alkaline earths, or their carbonates, are the most efficient remedies; of which the bicarbonates of soda or of potassa should be preferred Borax and phosphate of soda are said to be beneficial as solvents. Mucilaginous diluents, used freely, also promote this process. The causes should be ascertained and removed; a vegetable diet should be enjoined; alco-

holic drinks forbidden; acescent articles of food avoided; as well as all substances of difficult digestion. The skin and bowels should act freely. The bicarbonates of the alkalies are believed, by long-continued use, to exert a solvent power on the uric acid variety of calculi. In the second, or *phosphatic variety*, the deposit should be prevented by attention to the condition of the stomach, and the general state of the various functions of the body; opium is a very valuable remedy in this form; the free use of mineral acids has been found to be beneficial, as well as some of the vegetable. The alkaline bicarbonates (having an excess of carb. acid) are said to be beneficial, while the carbonates and pure alkalies are injurious. This form is peculiarly abundant in calcareous regions. In the treatment of the third variety, or the *oxalic diathesis*, the general condition of the system must govern. Sometimes a moderately antiphlogistic course is required, and at others the reverse; mineral acids have been recommended, combined with other tonics; also the sulphate of zinc, and the chalybeates. Fermented liquors, and all vegetable substances containing oxalic acid, should be avoided.

Pericarditis.

What are the *anatomical characters?* Redness, effusion of coagulable lymph, and a serous fluid in the pericardium.

What are the *symptoms?* Chills, fever, pain in the region of the heart, irregularity of pulse, palpitation, dyspnœa, &c.

The impulse of the heart is at first augmented, the sounds are increased in intensity, and, when endocarditis exists, are accompanied by a bellows murmur. On the second or third day, a rubbing or rustling sound may often be heard, occasionally changing to one similar to creaking of leather. The impulse of the heart, as well as both natural and morbid sounds, decrease with the progress of the effusion. There is an increase of fulness of the left side, and dulness on percussion is elicited over a larger space than natural, the limits of which define the degree of effusion.

Chronic Pericarditis is generally only the sequela of the acute variety.

What is the *treatment?* Vigorous antiphlogistic remedies must be used, such as bleeding, local and general; calomel and opium,

or calomel and Dover's powders, given so as to affect the gums, are important remedies. Diluent drinks, with nitrate of potash, tartrate of antimony, absolute repose, and emollient applications to the chest, are useful.

ENDOCARDITIS.

What are the *symptoms?* Besides the general symptoms of inflammatory reaction, there is violent action of the heart, augmentation of the extent of dulness on percussion, with the beat of the heart quite superficial. The most constant and characteristic of the phenomena of this disease is the bellows murmur. The chronic form may produce induration of the valves and narrowing of the orifices, indicated by the bellows murmur, or the rasping, sawing, or musical sound.

RHEUMATISM.

How is it *divided?* Into *acute* and *chronic.*

What *tissue* and *parts* are affected? The fibrous tissue, joints, tendons, and sheaths of muscles.

What are the *symptoms* of the acute? Pain in the part first affected, then swelling and extension to other parts, with fever, sweating, and a pungent odor arising from the perspiration. The fever is highest at night, the pain is increased by warmth; there is a tendency to effusion, and lesions of the heart mostly occur, which are indicated by their own peculiar symptoms.

At what *period* does *convalescence* occur? Rarely in the second week; most generally during the fourth, and often not until the sixth week; the pain, fever, and perspiration then lessen, the urine is more abundant and less charged with deposit, the appetite returns, thirst diminishes, and the pulse becomes natural.

What are the *causes?* Hereditary predisposition, cold; and it often occurs without any assignable cause.

What is the *treatment?* The principal indication is to moderate the fever; bloodletting should be practised according to the extent of fever and the plethoric state of the individual. Purgatives of calomel and senna, in the early stage, followed by nitrate of potash and tartrate of antimony, cooling drinks, and opiates at night, are useful. As local means, leeches, followed by poultices impregnated

with laudanum or decoction of poppy, are useful. After fever has subsided, blisters should be applied, and repeated when the joints are swollen.

In chronic rheumatism, local bleeding, blistering, &c., are useful. Dover's powders, warm bath, hydriodate of potash, tartarized antimony, tincture of aetea, colehicum, and flannel bandages, have reputation.

Gout.

What are the *symptoms?* What is called *acute gout* generally comes on suddenly, by aeute pain in the first joint of the great toe; sometimes it is preeeded by chill, fever, and restlessness: these symptoms are repeated every night for five or ten paroxysms, and subside. The affeeted part is swollen, has a shining appearance, and on its subsidenee the cutiele peels off. It may be considered a constitutional affeetion, and depends upon a gouty diathesis, either hereditary, or acquired by rich luxurious living and sedentary habits.

What is *retrocedent gout?* It is where gout is repelled, and attacks some internal organ; and may become a very serious complication.

What is the *treatment?* When the system is plethoric, diminish repletion by bloodletting. Purgatives are generally proper, and colehicum has a deservedly high reputation. The diet should be mild and simple.

Retroeedent gout may be relieved often by hot stimulating pediluvia or sinapisms, and the suffering organ must be relieved according as is indicated by its condition.

Variola, or Smallpox.

What is the most simple division of smallpox? Into *distinct* and *confluent;* in the former, the pustules are distinct, elevated, distended, and scattered over the surface of the body; in the latter, they are numerous, depressed, and confluent, or coherent.

What is the time between the reception of the variolous virus and the appearance of its effeets? This is called the period of incubation, and varies from nine to fourteen days.

What are the *stages* of this disease? The *initiatory*, the *eruptive*, the *maturative*, and the *declining*.

What are the *symptoms* of the *initiatory stage*? Rigors, followed by fever; pain in the limbs, back, and epigastrium; with vomiting, very similar to gastritis.

At what period does the *eruptive stage* appear? About the end of the third or beginning of the fourth day; some say sooner. It commences on the face, and extends over the whole body in about twenty-four hours.

At what period does the *maturative stage* occur? It is completed about the twelfth day, and preceded by exacerbations of fever, swelling of the face and other parts, for three or four days.

What is the period of *decline* or *desiccation*? It commences about the twelfth day; and in mild cases by the sixteenth or seventeenth day the fever subsides.

At what time is the *secondary fever* high, in confluent cases? At the period of complete maturation or suppuration, and during the first part of the declining stage.

Is smallpox apt to be a fatal disease? It is when in the confluent form, but not otherwise.

What is the *treatment*? In the initiatory stage the patient should be kept cool, and the antiphlogistic course pursued. Bleeding is proper in some cases; mild cathartics, saline draughts, and James's powder, may generally be used; but others require an opposite course.

In the secondary fever, the treatment should be governed by the condition of the patient, which varies much in different cases. In the mild forms, little else is needed than attention to the bowels.

Varicella, or Chicken-Pox.

What are the *symptoms*? Fever, mostly slight, continuing from one to three days, terminating in a vesicular eruption, which soon becomes shrivelled, and falls in scales about the ninth or tenth day.

What is the *treatment*? When treatment is necessary, it should be the same as that for mild cases of smallpox.

Rubeola. — Measles.

What are the *symptoms?* The period of incubation is generally from five to seven days. The first symptoms are those of catarrhal fever, followed by an eruption on the third or fifth day, of small red spots on the face, then on the neck, body, and extremities. They run into each other, and form semilunar or crescentic patches, and are at their height of development during the second day. Diarrhœa is a very common attendant.

What is the *treatment?* In general, all that is necessary is to keep the bowels open, and give tepid diluent drinks freely. When complicated, the treatment must be modified according to the symptoms. The *sequelæ* are bronchitis, pneumonia, pleuritis, dysentery, diarrhœa, or ophthalmia.

Scarlatina.

What are the essential phenomena of the disease? Fever, a peculiar eruption, and inflammation of the fauces, which sometimes terminates rapidly in sloughing and ulceration.

How is it *divided?* Into *S. simplex*, *S. anginosa*, and *S. maligna.*

What are the *symptoms* of *S. simplex?* They are fever, generally followed by a scarlet eruption within forty-eight hours, commencing on the face, and extending to the neck, trunk, and extremities, with a slight soreness of the throat. Both usually begin to decline about the fifth day, the skin desquamating.

What are the *symptoms* of the *anginose* variety? They are more severe than in the former; the eruption does not appear until the third day of fever, and then in irregular patches. In some cases, there is sloughing, but not always.

What are the *symptoms* of the *malignant?* It commences like the preceding, and soon becomes violent and dangerous. The period of eruption varies from the second to the fourth day. Gray sloughs, which become dark, are observable in the throat; the functions are all much disturbed, and death frequently occurs early in the disease from cerebral oppression.

The *prognosis* of scarlatina varies very much in different cases, and according to the variety.

What is the *treatment?* There can be no general directions given applicable in all cases. We must be guided by general principles.

In the *simple variety*, confinement to bed, a gentle aperient, abstinence from stimulating diet, and sponging the body when hot, will be about all that is usually demanded.

In the *anginose variety*, when the fever is active, and pulse full and hard, bloodletting may become proper, but should be used with caution: purgatives of calomel and rhubarb, or castor oil, &c.; leeches to the throat; cool air; sponging with tepid water; chlorine internally, pencilling the throat internally with nitrate of silver, capsicum, gargles, revulsive applications to the throat, &c., are the means used.

In the *malignant variety*, evacuants should be used with caution. The local means should be the same as in the preceding variety Diffusible stimulants are often demanded.

Hemorrhages.

What is hemorrhage? The escape of blood from vessels in which it is contained in a healthy state of the system; and may be *active* or *sthenic*, or it may be *passive* or *asthenic*.

What are the *indications* in the treatment of hemorrhage? To lessen the momentum of the circulation if necessary; to diminish the determination to the part from which it occurs; and to excite a contraction of the vessels of the part.

The first indication may be fulfilled by bloodletting, nitre, digitalis, cold, &c.; the second by counter-irritants and the direct application of cold; and the last by astringents either local or general.

Hemorrhage from the Nostrils. — Epistaxis.

What are the *symptoms?* It is the most frequent form of hemorrhage, and may be *active* or *passive* It is sometimes preceded by fullness, weight, and pain in the forehead, buzzing in the ears, and redness of the eyes; the blood discharged is usually of a florid color. It may be *caused* by direct violence, the result of plethora, a hemorrhagic diathesis, or symptomatic of some other affection.

What is the *treatment?* It is sometimes salutary when active, but when passive should be suppressed. The general indications should be observed and attended to; injections of strong solution of alum or other astringents may be necessary, should the application of cold not succeed; blisters to the nape of the neck or ankles are sometimes necessary. If these fail, direct compression and astringents combined should be used by the introduction of lint into the nostrils.

Hemorrhage from the Lungs.—Hæmoptysis. — Syn. *Spitting of Blood.*

What are the *symptoms?* Frequently, a tickling cough or other unusual sensation in the trachea, or larynx, inducing a slight cough, followed by the expectoration of blood; and nearly always preceded by sensations of fullness, weight, tightness, heat, soreness, and oppression over the whole chest, or portions of it, with general febrile symptoms. These symptoms are often more or less relieved by the hemorrhage.

The blood is usually liquid, florid, and more or less frothy, but varies somewhat in different cases, being sometimes in streaks, and sometimes coagulated. When effused into the interlobular cellular tissue, it has been called *apoplexy of the lungs.* It is frequently connected with phthisis, but not necessarily so; also with organic disease of the heart, aneurism, &c.; it may also be vicarious.

What is the *treatment?* Although sometimes salutary, we should always arrest it if possible. Quiet, elevation of the shoulders, freedom of motion of the chest, and fresh cool air, should be resorted to.

A teaspoonful of undissolved common salt should be slowly swallowed, and venesection resorted to, if there be plethora with a full, strong pulse.

Cooling cathartics and revulsives are proper, astringents and nauseants are also sometimes useful. When vicarious, a new indication of treatment is presented.

Hemorrhage of the Stomach. — *Hæmatemesis.*

Syn. Vomiting of blood. Gastrorrhagia.

What are the *symptoms?* It is mostly preceded by a feeling of fulness or pain about the epigastrium, or a sense of sinking or

faintness, eructations, irregular chills and fever, followed by vomiting of blood without much effort. Following this, there is often a discharge of fetid black blood from the bowels, which may continue for some days after the vomiting has ceased. The color of the blood vomited is also darker than natural, and the consistence is increased; the quantity varies much in different cases. It may occur from ulceration or congestion.

It may be *caused* by anything which irritates, or interrupts the flow of blood from the stomach; it may be vicarious of some accustomed discharge, which has been suppressed.

What is the *treatment?* Bloodletting, if there is marked sthenic action; cupping over the hypochondria, derivatives, and cathartics of calomel, followed by oil and turpentine; oil of turpentine alone is also highly recommended for checking the hemorrhage. Of astringents, opium and its preparations, acetate of lead, creasote, sulphuric acid, tincture of iron, &c., are used. Diet should be discontinued, and the drinks should be cool and mucilaginous or acidulated.

Phlegmasia Dolens.

What are the *symptoms?* Pain and stiffness in the groin of one side; rigors followed by fever; the limb becomes swollen, painful, tender, and of a knotted feel; the skin has a pale, white, smooth, and glabrous appearance. It is peculiar to the puerperal state; the breasts become flaccid, and their secretion is suspended.

What is the *treatment?* Decidedly antiphlogistic; bloodletting, purgatives, antimonials, &c.; after which opium, so as to allay pain and irritation, may be proper. As local applications, leeches, fomentations, solution of muriate of ammonia, and stimulating liniments, may be useful according to circumstances.

Apoplexy.

What is apoplexy? It is a disease characterized by a sudden suspension of the animal functions, a slow and full pulse, laborious or stertorous breathing, with a continuance of the vital functions.

What are the *premonitory symptoms?* Determination of blood to the head, indicated by throbbing and turgidity of the vessels, vertigo, ringing in the ears, pain, &c.

What are the terminations of an attack of apoplexy? In death during the paroxysm.

In perfect restoration of all the suspended functions.

In paralysis of certain parts of the body, with restoration of the functions in other respects.

And in general febrile condition.

How may it be distinguished from syncope and asphyxia? In these conditions, the pulse and respiration are absent or nearly imperceptible.

What is the *prognosis?* Unless appropriate and energetic treatment soon makes a favorable impression on it, the case is hopeless.

The *duration* of the attack may vary from a few minutes to several days. It generally occurs between the fortieth and sixtieth years of age.

What are the *causes?* Besides the predisposing from peculiar conformation of the body, age, plethora, and organic affections of the heart or large vessels, it may be excited by over-distension, improper food, straining, intoxication, mental excitement, the repulsion of cutaneous eruptions, impeded circulation, &c.

What are the *anatomical appearances?* Vascular turgescence of the brain, sanguineous extravasation, effusion of serum; and occasionally little or no traces of disease are discoverable.

What is the *treatment?* The grand indication is to remove the vascular engorgement of the brain; which is best accomplished by bloodletting, general and local, the application of revulsives to other parts of the body, with cold to the head. Active purgatives, emetics when the stomach is overloaded, and blisters, are important means.

What is the *prophylactic* management when the premonitory symptoms exist? A simple diet, exercise in the open air, avoidance of stimulating drinks and mental excitement, gentle cathartics if indicated, reduction of plethora, and an active course of life.

Paralysis, or Palsy.

What is paralysis? Impaired or abolished power of voluntary motion or sensation, or both, in some parts of the body, without coma or loss of consciousness.

What are the different *kinds* of paralysis? *Hemiplegia,* when the whole of one side of the body is affected.

Paraplegia, palsy of both inferior extremities from the hips downwards.

And *partial*, when some one particular part is affected.

What is the most common form of it? Hemiplegia: and it depends upon a similar condition of the brain to apoplexy.

Upon what does paraplegia generally occur? Affections of the spinal marrow generally.

What are some of the *causes* of partial paralysis? Affections of the brain or spinal marrow, injury of a nerve, and the action of lead.

What is the *treatment*? The same as for apoplexy, in most cases. The pulse must be our guide in the employment of the lancet; electricity is often useful, particularly in the partial variety; nux vomica, rhus toxicodendron, oil of turpentine, arnica flowers; and galvanism may also be tried, in chronic cases.

Epilepsy.

What is epilepsy? A disease of the nervous system, manifested by convulsions at uncertain periods, in paroxysms, with a temporary loss of consciousness and voluntary motion, terminating in sleep.

What part of the brain is usually found diseased in *post-mortem* examinations? The cerebellum.

What is the *treatment*? The cause should be carefully ascertained, and the treatment modified accordingly.

What are the *remedies* which have been thought to possess controlling power in this disease? Valerian, mistletoe, oil of turpentine, peony root, agaricus muscarius, artemisia vulgaris, belladonna, opium, stramonium, musk, castor, assafœtida, phosphorus, oxide of zinc, sulphate of zinc, nitrate of silver, ammoniated copper, indigo, &c.

Chorea, or St. Vitus's Dance.

What are its *characteristics*? Incomplete subserviency of the muscles of voluntary motion to the will, rendering their actions irregular, tremulous, and ridiculous. It may be general, or confined to particular muscles

What are the *causes?* Derangement of the bowels, mental excitement, and all causes of constitutional debility.

What is the *treatment?* It should depend upon the condition of system producing or accompanying it; to which the treatment should be adapted. Among the remedies recommended are purgatives, the vegetable and metallic tonics, belladonna, cimicifuga, counter-irritants, galvanism, &c.

Convulsive Affections of Infants.

What are the exciting *causes?* Any causes which produce turgescence of the brain; the most frequent of which are intestinal irritation, dentition, worms, repelled cutaneous eruptions, plethora, and local injuries.

What are the indications in the *treatment?* To obviate the influence of the exciting cause; to allay nervous or cerebral irritation; and to protect the brain from the determination to it.

Tetanus.

What is tetanus? It consists in violent tonic spasms of the voluntary muscles, with the power of sensation and thought unimpaired.

How is tetanus *divided?* According to the part which is affected; when confined to the muscles of the jaw, it is called *trismus;* when the extensor muscles of the trunk and extremities are the seat, *opisthotonos; emprosthotonos,* when the body is curved forwards; and *pleurothotonos,* when in a lateral direction.

When it occurs in children, it is called *trismus nascentium.* It has also been divided into *idiopathic* and *symptomatic;* the former is produced by direct irritation of the nervous system, and the latter by indirect; that following wounds is called *traumatic,* and belongs to the symptomatic variety.

What are the *symptoms?* Slight spasms about the larynx, a feeling of stiffness of the jaws, neck, and shoulders, with spasms. When it terminates fatally, it is usually by apoplexy.

What is the *treatment?* In the idiopathic, particular attention should be given to the condition of the system, and the treatment adapted to its condition accordingly. In the symptomatic, attention

both to the general condition and to the local cause of irritation, is necessary.

The *remedies* that have been used are bloodletting, purgatives, sedatives, particularly opium, tobacco, antimony, hydrocyanic acid, cold affusion, mercury, amputation, tonics, wine, bark, &c., all of which may be proper when rightly adapted.

Asthma.

Syn.—Spasmodic Asthma.

What is understood by asthma? It is a term which has been indefinitely applied as synonymous with dyspnœa, but, while this latter is a *symptom* of various diseases, asthma indicates a *disease* characterized by difficulty of breathing, occurring in paroxysms, and depending upon spasmodic constriction of the bronchial tubes, without fever as a necessary accompaniment, or any organic disease of the lungs or heart.

What are the *symptoms?* It is usually preceded by languor, headache, flatulency, constriction of the chest, &c. There is great difficulty of breathing, and a feeling of impending suffocation, which often commences in the night and wakes the patient out of sleep, and compels him to seek the fresh air. The countenance indicates great distress. The pulse is often small, feeble, irregular, and frequent; the eyes are prominent, and the extremities cool; the urine generally pale and abundant in the commencement and during the paroxysm, but becomes scanty and high colored, and sometimes deposits a sediment. After three or four hours, the symptoms usually subside, with a copious expectoration of mucus, and then it is called *humid asthma;* when this does not take place, it has been called *dry asthma.* Soreness of the muscles remains, and sometimes neuralgic pains occur. The asthmatic symptoms are slight through the day, and at night the paroxysms occur again; this alternation often continues for a week, leaving at the end of that time the patient in ordinary health.

What are the *physical signs?* Percussion is clear throughout the chest, when there is no complication. The respiratory murmur is feeble, with a sibilant or wheezing sound. When relaxation, either temporary or permanent, occurs, the air enters the lungs freely, producing its accustomed phenomena.

It is sometimes hereditary, and the *predisposition* may be caused by a great variety of circumstances. The most frequent *exciting* cause is cold and moisture combined. It is sometimes found associated with organic diseases of the thoracic viscera, either as a cause or effect.

What is the *prognosis?* It is occasionally cured, but more frequently relieved; when once established, it is apt to recur during life. It is seldom fatal, unless complicated with other affections of a serious character.

What is the *treatment?* The two prominent indications are to relax the spasm, and to destroy the predisposition. The first can generally be accomplished by the use of *emetics*. Bleeding may be necessary, provided there is a strong, excited pulse, but not otherwise. *Antispasmodics* are sometimes useful.

Some *narcotics* have been used, among which stramonium stands the highest. Hot foot-baths are useful. Attention should be given to the general health, and any deviation corrected as far as possible.

Neuralgia of the Face, or Tic Douloureux.

What are the *symptoms?* The portio dura of the seventh pair is mostly the nerve affected; sometimes the fifth pair. Severe pain, shooting in a direction corresponding to the course of the nerve, occurs in paroxysms, and is brought on by slight causes; the muscles are occasionally affected with convulsive twitchings.

What is the *treatment?* Narcotics, nervines, and local irritants, division of the affected nerve; carbonate of iron has been highly extolled; also bark, arsenic, &c.

When it is intermittent, with regularity of periods, quinine with morphine will very certainly relieve it.

Mental Derangement.

What are the *causes?* They are *hereditary* and *exciting;* the latter of which is divided into *moral,* or those which operate through the medium of the mind; and *physical,* or those which act directly on the body.

How are diseases of the mind *divided?* Into *mania, monomania, dementia,* and *idiotism.*

What are the *characteristics* of MANIA? General mental derangement, characterized by a rapid succession of incoherent ideas, and violent excitement of the passions, expressed by great agitation, loud vociferation, singing, menaces, and fury.

What are the *characteristics* of MONOMANIA? It is a state of partial insanity, where the patient is insane on one subject only, with a full and regular use of his intellectual faculties on all or most other subjects. It comprehends many varieties, as nostalgia, fanaticism, hypochondriasis, melancholia, misanthrophy, &c.

What are the *characteristics* of DEMENTIA? There is an association of unrelated perceptions or ideas, from an inability of the mind to judge and reason.

What are the *characteristics* of IDIOTISM? It consists in a defective development or impairment of all the intellectual faculties, sometimes amounting to total absence of mind.

What is the *general treatment* of mental derangement? The patient should be removed from his friends and home, placed in some quiet and secluded situation, have kind and humane treatment, free exercise in the open air, such employment and amusements as are adapted to his condition, and appropriate remedies, adapted to the general state of health and condition.

DELIRIUM TREMENS. — MANIA A POTU.

What are the *characteristics?* General inquietude, tremors, continued watchfulness, cool skin, perspiration, delirious loquacity, and sensorial illusions; occurring in habitual drunkards and opium-eaters, generally following the intermission of their accustomed stimulant.

What is the *treatment?* Emetics, opium, antispasmodics, and the alcoholic treatment, all have their advocates. The alcoholic treatment has been found the most successful in the Philadelphia Hospital; but the treatment with opium is perhaps more generally practised than any other, either alone, or in combination with camphor and assafœtida.

PERTUSSIS, OR HOOPING-COUGH.

What is pertussis? It is a contagious cough, which has a regular rise, progress, and declension, and occurring but once in the same individual.

What are the *symptoms?* It commences as an ordinary catarrh, with lassitude, sneezing, headache, and hoarseness, followed by a dry ringing cough, which at the end of two or three weeks becomes convulsive or spasmodic, and in paroxysms.

What is the *prognosis?* It rarely terminates fatally, except by the supervention of bronchitis, hydrocephalus, pneumonia, apoplexy or marasmus. The younger the patient, the more apt is the disease to terminate fatally. It often calls into action strumous and tuberculous affections.

What is the *treatment?* It is capable of being mitigated, but not cut short in its course. When attended with inflammatory symptoms, bloodletting, general and local, may be serviceable, and when the lungs are oppressed by the bronchial secretions, emetics are indicated. Assafœtida is an excellent remedy, with or without nauseants. Belladonna, lobelia, and counter-irritants, are also valuable remedies.

Asphyxia, or Suspended Animation

What are the *causes* which produce asphyxia? Hanging, drowning, or strangulation, and the inhalation of some irrespirable gas; also lightning or electricity, and intense cold.

What are the *symptoms* of asphyxia from *drowning?* A tinged and livid appearance of the face; the eyes are open and staring, limbs stiff, tongue protruded, the epigastrium tense and tumid, and the manifestations of life are destroyed. According to Orfila, more or less water enters the stomach, by which he distinguishes between cases of drowning, and cases where life was destroyed before being placed in the water.

What is the *treatment?* The person should be well dried, wrapped in blankets, and placed in a convenient place for artificial inflation of the lungs, by a common bellows. Galvanism and electro-magnetism if at hand, stimulant injections into the rectum, and frictions may be very useful in assisting to establish respiration, and revive the energies of the system. Heat should be applied by warm flannel, bottles of hot water, bricks, &c., in a gradual manner. When the functions are partially resumed, stimulus, carefully adapted, may be useful, and the patient should be kept perfectly at rest in a dry warm bed. These means should be persevered in and not abandoned too hastily.

What are the *symptoms* of asphyxia from the *inhalations* of *carbonic acid gas?* When undiluted, it will quickly destroy life, but mixed with atmospheric air it is less sudden, producing vertigo, faintings, insensibility, and asphyxia; in which case the face has a tumid and livid appearance; the blood-vessels are turgid, and the tongue swollen. It acts both by excluding the atmosphere, and as a poison.

What is the *treatment?* When the asphyxia is incomplete, recovery will soon take place by placing the patient in the open air, dashing a little cold water upon him, dry frictions, and wine and water. When perfect, the cold dash, or pouring water on the head, will often excite respiratory movements; frictions with dry flannels or stimulating substances, volatile applications to the nose, &c., are proper. If these do not quickly excite respiration, artificial respiration should be resorted to.

What is the *treatment* for asphyxia from *electricity?* The same as that for asphyxia from carbonic acid, and other mephitic gases; cold affusions are particularly valuable in such cases.

What is the *treatment* of asphyxia from *cold?* The principal means is the gradual communication of warmth to the body; but it has to be done with the greatest caution, or it will destroy the little remaining vitality, or produce gangrene. The first applications then should be cold water or snow, then dry blankets in a room without fire; gentle frictions, and artificial inflation of the lungs, unless respiration takes place. If symptoms of life occur, the warmth may be increased, and warm drinks administered, of balm or sage tea, but stronger stimulants should be avoided.

DIARRHŒA.

What are the *characteristic symptoms?* Frequent, and usually copious liquid feculent stools, with griping.

What is the morbid condition upon which diarrhœa depends? An irritated condition of the mucous membrane of the bowels, either from the action of irritating substances upon it, or from an increase in its irritability, in which case the ordinary secretions and contents of the canal will produce excessive peristaltic action.

What are the *indications of treatment?* To remove every source of intestinal irritation; to allay the morbid irritability of

the mucuous membrane of the bowels; and to diminish the determination of the blood to the intestinal canal.

Cholera Morbus.

What are the *characteristic symptoms?* Frequent, violent vomiting, and purging, with severe tormina, and cramps in the muscles.

What are the *indications of treatment?* To allay as quickly as possible the irritability of the stomach and bowels, to restore the action of the skin and liver, and to determine the circulation from the internal to the external parts. Energetic means should at once be resorted to for these purposes, and opium, calomel, and active revulsives, will generally fulfil the indications.

Cholera Epidemica.

Synonyme. Spasmodic Cholera.—Indian Cholera.—Asiatic Cholera.—Malignant Cholera.—Cholera Asphyxia.

What are the *symptoms, course,* &c., of this disease? It is usually preceded and accompanied with an epidemic prevalence of disordered stomach and bowels, as indigestion, diarrhœa, or dysentery. The term *cholerine* is applied to cholera mild in form, but without decided cholera symptoms; this condition is often the *first stage* of the disease, and should be always looked upon in that light.

The disease depends upon an unknown *cause,* which produces an epidemic influence, rendering most persons in certain places liable to this disease upon the application of an exciting cause; or sometimes without any that is apparent. The attacks are sometimes gradual, or preceded by what have been termed *premonitory symptoms,* or *cholerine;* but frequently they occur suddenly, and the disease runs its course with fearful rapidity. The first operations of the bowels and vomiting throw off the ordinary contents of stomach and bowels, but are soon followed by thin rice water discharges. Cramps usually occur in the extremities, and are often very severe; yet they are absent in many of the severest cases. The pulse soon sinks; there is great thirst; the surface becomes cold, and bathed in sweat; the urine is scanty or entirely suppressed; the skin assumes a leaden or violet color, with a haggard

and death-like countenance; and the whole body presents a shrunken appearance. An apathy usually accompanies this disease in patients, in reference to their own ease and towards every surrounding object. These symptoms, if they increase and continue, soon terminate in *collapse* of a more or less decided character, in which the pulse is imperceptible or very feeble; or a feeble oscillatory movement of the heart alone may be detected by auscultation. This condition usually terminates in death, but occasionally in reaction; if in reaction, there is usually more or less congestion of important organs, and a longer or shorter course of febrile symptoms of a typhoid character, from which the patient may recover or may not. The latter part usually presents considerable variety in reference to local complication and mode of progressing.

It has properly been divided into four stages. The *first*, or forming, consisting of diarrhœa and other symptoms known as *cholerine*. The *second*, or when decided symptoms of cholera exist, but with the circulation distinctly observable in the larger vessels. The *third*, or stage of collapse. And the *fourth*, or that of reaction; in which the cholera symptoms proper are replaced by local inflammations, congestions, irritation, and general fever.

The *essential* and *specific cause* of this disease is unknown, but many circumstances contribute to its development either by *predisposing* to or *exciting* it.

The causes which *predispose* are whatever is calculated to weaken the vital energies of the system.

The causes which *excite* it are those which make a sudden and powerful impression on the system, and whatever can irritate the stomach and bowels or produce a determination of blood to them. Exposures to sudden changes of temperature, mental emotions, indigestible food, purgatives, &c., may therefore act as exciting causes.

What is the *prognosis?* When in the forming or cholerine stage it can generally be arrested by appropriate treatment; and even when completely formed it will terminate favorably, in the large majority of cases, if properly managed; while in the stage of collapse, treatment is usually of little avail.

What is the *treatment?* The indications in the *first* and *second* stages are to arrest the evacuations from the stomach and bowels; to relieve irritation in them; to restore the suspended secretions,

especially of the liver; to equalize the circulation; to relieve nervous disturbance; and to support the general strength when deficient. Calomel, opium, and camphor seem well calculated to fulfil a majority of these indications, when given in small doses frequently repeated. Caution should be observed in reference to the use of opium and camphor, and particularly of the former, so as not to depress the nervous system below the proper condition of impressibility, or produce congestion of the brain; this latter danger increases as the disease progresses, or collapse is approached.

Astringents have been advised in combination, but it is probable that their effect in disturbing the stomach generally more than counterbalances any good which may result from them. When these are resorted to, the sugar of lead dissolved in paregoric is an acceptable and efficient form for administration.

Revulsives should be applied to the surface freely; a blister of cantharides, assisted by hot oil of turpentine over the bowels, is their most efficient form; hot footbaths and mustard plasters are also useful. In allaying the irritability of the stomach, aromatics are sometimes beneficial, and ice also in some cases. Mint julep, combining ice, aromatics, and alcoholic stimulus, is esteemed highly, given in small doses. In the stage of diarrhœa, calomel or blue pill, opium and camphor, will nearly always succeed in curing promptly.

In the *third*, or stage of *collapse*, the indications are about the same as in the previous stages, and in addition we should endeavor to check excessive sweating, and supply the loss of watery and saline matters to the blood. The same remedies may be resorted to except the opium, which should not be given; camphor should be given sparingly if at all; alcoholic stimulants used with the greatest caution or entirely withheld, on account of the disposition to cephalic affection. Although the apparent condition seems to call for the use of stimulants, they are not to be used except with the greatest caution. In the *fourth* stage, the treatment must conform to the pathological conditions existing; and as these vary somewhat, the treatment must correspond. Great caution should be observed in both medicines and diet, or mischief may result.

In reference to *prophylactic measures*, much benefit occurs from the use of such diet as will preserve the digestive organs in the best possible state, and also the general system. The diet should

be plain, nourishing, and full in quantity, without overloading either the stomach or the circulation An inerease of the vital funetions is preferable to depression; moderate stimulation of the stomach after meals is advisable with sueh artieles as ginger, mustard, pepper, &e. The mind should be equable, ealm, and hopeful; exeesses of all kinds, mental and physieal, avoided, as well as exposures to ehanges of temperature.

A great variety of plans of treatment have been pursued, whieh space will not permit us here to notiee.

Flatulent Colic.

What condition of the digestive organs predisposes to this disease? A weak and irritable state of them. Ordinary artieles sometimes, but particularly substanees not easily digested, are mostly the exciting causes.

What are its *characteristics?* Pain in the stomaeh and bowels, sooner or later after eating, oecurring in paroxysms, with short remissions, eructations of wind, and torpid bowels. It may be distinguished by the relief obtained from abdominal pressure, the writhing motions of the patient, and the absence of fever. From *bilious colic*, by the absence of bilious vomiting; and from *colica pictonum*, by the hardness and retraetion of the abdominal museles, and the gradual aeeession of the eolie prodneed by lead.

What is the *treatment?* When the symptoms are slight, frictions with a flannel or a brush, and the milder earminatives and antispasmodies, are all that may be required. When more severe, camphor, ether, laudanum, &e., may be neeessary; but when the irritating substance still remains, and the pains do not abate, proper evaeuants must be resorted to; emeties, if the offending substanee is still in the stomach; and eathartics, or laxatives, if it have passed into the intestines. Revulsives, sueh as sinapisms, heat, &c., applied to the abdomen, are useful. In convaleseenee, great eare should be taken in regard to diet.

Bilious Colic.

What is bilious colic? It is a variety of colic with manifest derangement of the biliary organs.

What are the *causes?* It depends upon the same remote causes which produce intermitting and other forms of miasmatic fevers, and generally occurs during the autumnal months.

What are the *symptoms?* In the first stages, the symptoms resemble those in the forming stages of miasmatic fevers. These are followed by acute pain in the stomach and bowels, which is very severe during the exacerbations. As the disease advances, the abdomen becomes tender to the touch. Nausea and bilious vomiting occur often, at the commencement of the disease; the bowels are torpid; the pulse is not much disturbed at first, but becomes increased in fulness, force, and frequency, as the disease advances, and there are symptoms of bilious derangement.

What is the *treatment?* The principal indications are, to free the bowels of their irritating contents, to allay the morbid irritability of the stomach and intestinal tube, and to restore the healthy secretions of the liver. The first indication can be accomplished by an emetic, if free vomiting does not exist, and by cathartics as soon as they can be brought to act; but, from the usual irritable condition of the stomach, this cannot at once be done; *calomel*, in small doses repeated, then becomes the most important remedy conjoined with revulsives, which will generally allay the irritability of the stomach, and bring the system under its peculiar influence; which is favorable to the operation of cathartics, and the restoration of the secretions. As a purgative, castor oil and spirits of turpentine, as soon as the stomach will bear them, will be found beneficial. Warm bath, fomentation, bloodletting, &c., may be found useful during the course of treatment, according to the condition of the system.

Colica Pictonum, or Lead Colic.

What are the *symptoms?* The ordinary symptoms of colic, a twisting pain around the navel, pain in the back, tenesmus, and sometimes vomiting. Palsy, and wasting of the muscles of the forearm and hand, are occasional results.

What is the *treatment?* Venesection, purgatives, opium fomentations, and revulsives. Castor oil is one of the best purgatives in such cases, and may be properly combined with opiates. Sometimes tobacco enemata have been recommended. Cold affusions have also been found useful.

Constipation.

What is understood by constipation? A condition of the bowels in which the stools are less frequent or less in quantity than in health. This condition is apt to occur in dyspeptics, and in old persons, and the accumulations are sometimes enormous in the colon and rectum. It may be produced by a variety of *causes*, and depend directly on different *pathological conditions*, such as mechanical impediments to the passage of the alvine contents along the bowels; a diminished contractility of the muscular coat, or diminished susceptibility to alvine stimuli; a deficient supply of stimuli; or a combination of two or more of the conditions mentioned.

What is the *treatment?* In *occasional* attacks, mild cathartics, such as castor oil, should be used; and, if attended with torpidity of the liver, calomel should be added. Enemata are also often useful to quicken the operation of cathartics. In *habitual* constipation, attention must be particularly paid to a removal of the cause. Regular efforts to evacuate the bowels should be made, without straining; moderate exercise, regular habits, relaxation from mental exercise, change of air, frictions over the surface of the body, cold shower bath, and the avoidance of the use of coffee and green tea. The diet should be regulated, by using food easily digested, and calculated to act slightly on the bowels. The particular articles used must depend upon the capacity to digest them, which, in many cases, can only be known by a careful trial. Sometimes mechanical assistance is required in dislodging impact feces from the rectum. Tonics and laxatives are often beneficial and necessary; but caution should be observed in reference to the habitual use of cathartic substances.

Obstruction of the Bowels.

What is meant by obstruction of the bowels? A mechanical resistance or impediment to the passage of the contents of the bowels. It may come on slowly or suddenly.

What are the *symptoms?* A feeling of uneasiness, distension, or pain in the abdomen; the pain may be excessively severe, and of a spasmodic kind, followed by obstinate vomiting and tenderness; also fever, hiccough, and stercoraceous or bloody ejections

from the stomach; tympanitis, oppressed respiration, clammy skin, feeble pulse, &c., if not soon relieved. The terms *Ileus* and *Volvulus* have been given to cases of stercoraceous vomiting. When the above named symptoms occur, a *careful* examination should be made, in order to ascertain whether or not they are caused by *strangulated hernia*, concealed or otherwise.

One of the most frequent *causes* is an *accumulation of impacted feces*, which, however, is the least dangerous of the different forms of obstruction.

The *formation of solid concretions* is another cause, and may originate in various modes; medicines and indigestible food sometimes collect together and form hard concretions, such as chalk, magnesia, sulphur, stones of various fruits, &c. To detect these, the previous habits of the patient should be inquired into; and they may also be detected occasionally by examination per anum, or over the parietes of the abdomen; when tenesmus occurs, the rectum should be particularly examined.

Permanent stricture of the bowels is another source of obstruction, depending in most instances on a thickening of the parietes of the bowels, or a cancerous degeneration; it may occur also from *inflammatory adhesions* of various kinds, and from fatty depositions beneath the peritoneal coat.

Intussusceptio or *invagination* of the bowels is a frequent and fatal form of obstruction; it consists in the reception of one portion of intestine into another portion, immediately above or below, generally below, and may vary from a few lines to a foot or more; it may occur at almost any portion, but is said to be more frequent at the union of the small with the large intestine.

Twisting of the bowels is another cause; and consists in a fold or loop of the intestines turned round upon itself one or more times.

Obstruction may also be caused by *organic tumors*, situated exterior to the bowels; but this is rare.

What is the *treatment?* First, if possible, ascertain the cause, and adapt the treatment accordingly. If this is obscure, adopt the plan most likely to be successful in the curable forms of the disease; abstract blood, if the pulse will admit, in quantity to accomplish the object of lessening its force, relaxing the system, and abating inflammatory symptoms; local bleeding by leeches to the anus or

abdomen is often beneficial. The milder cathartics, such as castor oil, sulphur, magnesia, senna, &c., should be used, followed by enemata. The powerful cathartics should be used cautiously, if at all. Calomel should be given freely, which will generally be retained, and if it do not operate may produce a general mercurial impression which sometimes proves advantageous under favorable circumstances. During this treatment, opium should be given to allay pain and relax spasm; and warm fomentation and the warm bath often prove valuable auxiliaries. Repeated injections of warm water with a forcing pump are also often an efficient remedy. Tobacco enemata have been used, but great caution is necessary.

Prolapsus Ani.

What are the *symptoms?* It consists in a descent of a portion of the rectum or its lining membrane below the sphincter, forming a tumor at the anus. Sometimes the protrusion occurs suddenly and largely, but it is generally small, in the form of a regular ring, about the anus; appearing when straining at stool, and receding spontaneously, or by slight pressure, after the straining ceases. If not arrested, it continues, and becomes swollen and painful or indurated, and is returned with difficulty.

What are the *causes?* Anything which causes severe straining or relaxation of the bowels, or the two combined; it is more common in children and in old persons than in the middle period of life.

What is the *treatment?* The objects are to effect the reduction, and prevent the return of the prolapsed bowel. The first may generally be accomplished by pressing gently against the tumor, or by inserting the index finger into the anus, and in this way pushing up the part. If prevented by the constriction of the sphincter, use the warm hip-bath, warm poultices, laudanum injections, and bleeding, if necessary to produce relaxation; cold, suddenly applied, often relieves. If much inflamed, the antiphlogistic course, such as bleeding and cold applications, with a proper posture, should be resorted to.

In the prevention of prolapsus, irritation of the rectum should be avoided; obviate relaxation of the sphincter; contraction of the relaxed membrane liable to protrusion should be produced. To

accomplish the *first*, the bowels should be kept regularly open by laxative diet and medicines, provided costiveness exist; if the bowels should be too loose, means proper to rectify this condition should be used.

The *second* object should be effected by cold water, astringent injections, or suppositories, and the internal use of terebinthinates.

In effecting the *third* object, vegetable and mineral astringents should be used by injection. In old cases, where there is great relaxation, it may be necessary to clip off a portion of the inner membrane, or apply caustic to it; some have recommended, in extreme cases, a removal of the indurated portion; the application of mechanical support to the parts may give relief.

Worms in the Alimentary Canal.

What are the different species? There are five: 1. *Ascaris lumbricoides, Round worm;* called also *lumbricus*, and *lumbrici*, plural; from resemblance to the common earthworm. Has a cylindrical body, tapering towards the extremities, and is from six to twelve inches long.

2. *Ascaris vermicularis. Thread-worm. Seat-worm. Maw-worm.* Plural term *Ascarides;* the smallest of the intestinal worms; male two lines, female five lines; slender, white, and resembles a piece of thread.

Tricocephalus dispar. Long thread-worm is an inch or two in length, consists of two distinct portions; the anterior, about two-thirds of the whole length, is about the thickness of a horse-hair, and suddenly swells out into a thicker but shorter portion; hence the name.

Tœnia Solium. Common tape-worm. It varies in length from five to ten feet, but sometimes is much longer; it is flat, and where largest three or four lines broad. The body consists of numerous segments, longer than broad, resembling the seeds of a gourd, hence the name sometimes given of *Tœnia cucurbitana*, or *gourd-worm*.

Bothriocephalus latus. Tœnia lata. Broad tape-worm. The body long and flat, and broader than the Tænia.

What are the *symptoms?* Uneasiness or pain in the abdomen, sometimes spasmodic, at other times gnawing or biting, or an inde-

scribable distress. A sympathetic itching at the anus and nostrils; the bowels often disordered, being sometimes costive, and at others too loose; appetite variable; swellings of the upper lip and abdomen, &c. Disorders of the nervous system may be developed, such as wakefulness, fretfulness, starting in sleep, vertigo, headache, dilated pupils, perverted vision, blindness, tinnitus aurium and deafness, convulsions, chorea, spasm of the glottis, &c. A febrile condition of the system known as *worm fever* also often occurs. It is not, however, always easy to say that worms are the cause of these symptoms when they exist; but that the relation of cause and effect does frequently exist there can be no doubt, because they are found to disappear at once on the removal of worms from the alimentary canal.

The *causes* are extremely obscure, although it is found that crude vegetables and imperfect digestion favor their production.

What is the *treatment?* The indications are to *expel* the worms from the bowels, and to *prevent* their reproduction. Their expulsion may be accomplished by cathartics and anthelmintics combined, either given together or the latter first and followed by cathartics. To prevent the reproduction, attention should be given to the food and drink; and the tone of the stomach should be increased by tonics, exercise, &c.

HÆMOPTYSIS.

What is understood by this term? A discharge of blood from the lungs. It may occur under three forms, viz.: from the bronchial mucous membrane, from pulmonary apoplexy, and from the ulceration of a blood-vessel in a tuberculous cavity. The first form is the most common, and may be caused by the cessation of any accustomed discharge; and also by anything that may produce an irritation of the lungs or mucous membrane. The pulse is generally quick and bounding.

What is the proper *treatment?* If plethoric, and an irregular determination of blood, venesection should be employed. Rest; avoid conversation, and everything stimulating; be placed in a cool, airy room; and the bowels should be freely operated upon. External irritation and cupping may be necessary; and also nauseants; and astringents, of which the sugar of lead is the best.

Chronic Diseases of the Skin.

What are the primary divisions in the classification of Wilson? They are diseases of the *Dermis*. Diseases of the *Sudoriparous Glands*. Diseases of the *Sebaceous Glands*. Diseases of the *Hair* and *Hair-Follicles*.

This division is founded upon the anatomy and physiology of the part, and in many respects is superior to every other classification.

It has been termed a "*Natural System of Diseases of the Skin.*"

What is the preferable division to facilitate diagnosis? It is the classification of Willan, as modified by Worcester.

What are the divisions of this system? There are two groups, the *dry* and the *moist*.

What are their *characteristics?* The *dry* diseases are those unattended with any secretion or effusion of fluid in their primary or elementary form; while the moist are attended in their elementary condition with an effusion of fluid.

Upon what condition are the different orders of Willan founded? The elementary appearance of the eruption; and are the *Vesiculæ*, *Bullæ*, *Pustulæ*, *Exanthemata*, *Papulæ*, *Squamæ*, *Tuberculæ*, and *Maculæ*. The first three of these orders belong to the *moist group;* and the last five, to the *dry*.

What are the proper rules for diagnosis under this arrangement? Ascertain the primary condition of the eruption, whether it belongs to the dry or to the moist group. If the primary condition has passed in the part principally affected, examine the edges, or near it, where the primary form can generally be distinguished in the appearance of successive eruptions. If this cannot be done, possibly the friends may inform you whether it was at first a vesicle, a pustule, or a papule, &c.; from their descriptions, you may mostly be able to fix the group and the order with considerable certainty. If it is a moist disease, or attended with effusion, it must be one of three orders; on the contrary, if dry, it must belong to one of five orders; in this way many diseases are at once excluded from our diagnosis; the number of diseases being made narrower, and, of course, diagnosis simplified.

ORDER 1. — VESICULÆ.

What are the *characteristics* of this order? There are small elevations of epidermis, filled with a fluid, clear at first, but generally afterwards becoming more or less opaque; they terminate in the formation of scales or crusts, either by the fluid being absorbed or effused upon the skin.

The diseases of this order are, *Eczema*, *Miliaria*, *Herpes*, and *Scabies*.

Eczema.

Synonymes.—Humid tetter, epidemic itch, crusta lactea.

What are its *characteristics?* Numerous small agglomerated vesicles, filled at first with a clear transparent serum. Three varieties, *Simplex*, *Rubrum*, and *Impetiginodes*. Also divided from location, *E. Capitis*, *Faciei*, and *Genitalis*.

What is the *treatment?* In the young and healthy, antiphlogistic, general and local; particularly in the early stage. After inflammation is subdued, and in the aged and debilitated, the milder tonics, laxatives, and alterants, are proper. The local applications are numerous; ointments of nitrate of silver, iodide of sulphur, &c., are used; also alkaline washes and liniments, and particular attention should be paid to cleanliness.

Sudamina.

What are they? Small, distinct, isolated vesicles, of a round form; which occasionally accompany rubeola, scarlatina, variola, rheumatism, typhoid fever, &c. They in themselves require no treatment; but the condition of system in which they appear may require attention.

Herpes.

Synonyme.—Tetter.

What are the *characteristics?* Non-contagious vesicles of various sizes, from a pin's head to that of a pea, grouped upon a circumscribed, inflamed base; they sometimes become very large from the confluence of smaller ones. There are four varieties, viz.: *H. Circinatus*, *H. Zoster*, *H. Iris*, and *H. Phlyctænodes*, which depend upon the form and arrangement of the vesicles and groups.

There are also some local divisions depending upon the part attacked.

What is the *treatment*? But little treatment is generally required; in the young and plethoric, a moderately antiphlogistic course; and when the constitution is debilitated, or in the aged, a tonic and alterant course may become necessary. As local applications to allay smarting and itching, emollient poultices and alkaline washes are often demanded, combined with some narcotic.

Scabies. Itch; Gale; Psora.

What are the *characteristics*? Distinct, acuminated, transparent vesicles; contagious, and occurring at first in parts of the body where the skin is thin and delicate. It is caused by the Acarus Scabiei, which is the diagnostic.

What is the *treatment?* Sulphur, internally and externally.

ORDER 2. — BULLÆ.

What are the *characteristics* of this order? It differs from the vesiculæ only in size. The bullæ are generally circular, varying in size from a split pea to an egg; and terminate in a crust or scab usually, and comprise two diseases, viz.: *Pemphigus* and *Rupia.*

Pemphigus.

Synonymes.—Pompholyx, Febris Bullosa, Bullæ, &c.

What are the *characteristics?* Blisters or blebs, generally of a round form, varying in size from a split pea to an inch in diameter; sometimes they coalesce so as to form larger ones; they contain a serous or sero-purulent fluid. It may be acute or chronic.

What is the *treatment?* In the acute form, laxatives, diluent drinks, rest, spare diet, and if necessary venesection. In the chronic form, alkaline or mucilaginous baths, mild diet, good air, mild laxatives, alterants, and tonics.

Rupia.

Synonymes.—Ulcus atonicum, Phlyzacia.

What are the *characteristics?* Large, flat, distinct bullæ, resembling pemphigus, at first filled with serum, which soon becomes opaque, sanious, or purulent; they form thick scabs of an imbri-

cated character, under which is an ulceration of a greater or less depth. There are three varieties, viz.: *R. Escharotica*, *R. Simplex*, and *R. Prominens*.

What is the *treatment?* Nearly the same as in pemphigus; only the tonic portion of the treatment should be more active. Various local applications are used.

Order 3. — Pustulæ.

What are the *characteristics* of this order? Small, distinct tumors filled with purulent matter, which may be absorbed, ruptured, and form scabs, or become tubercular. It includes three diseases, viz.: *Ecthyma*, *Acne*, *Impetigo*.

Ecthyma.

Synonymes.—Furunculi, Atonici Agria, Phlyzacia, &c.

What are the *characteristics?* Non-contagious, distinct pustules, often of considerable size, scattered, not numerous, or approximated. There are two varieties; the *acute* and *chronic*.

What is the *treatment?* Remove the cause when known, use mild unstimulating diet, correct the secretions, enjoin good air, cleanliness, and baths adapted to the case.

Acne.

Synonymes.— Varus, Rosacea, Gutta Rosea or Rosacea, Copper Nose.

What are the *characteristics?* Non-contagious, small pustules, upon a conical inflamed base, which continues hard, usually of a dull red or livid color; often exists from puberty to the age of twenty-five or thirty. Its true pathology is an inflammation of the sebaceous follicles; the black point on the summit of the pustule is formed by the orifice of the duct. There is one general and three local varieties, viz: *Acne Simplex*—and *A. Rosacea*, *A. Sebacea*, and *Sycosis*. The first usually attacks the back, neck, shoulders, face, arms, &c.; the second attacks the nose; the third often attacks the face, and is characterized by a large secretion of sebaceous matter; the fourth, or sycosis, attacks the upper lip, chin, and cheeks of adult males, or such parts as are covered by the beard;

it there affects the sebaceous and hair follicles, and the inflammation may extend to the cellular membrane beneath.

What is the *treatment?* Remove the cause when known; antiphlogistics, general and local, are necessary; the vapor bath, or douche, iodide of sulphur ointment, &c., are used, and attention should also be given to the digestive organs, and to the general state of health.

Impetigo.

Synonymes.—Milk Crust, Crusted Tetter, Running Tetter, &c.

What are the *characteristics?* Non-contagious, grouped, agglomerated pustules, without an inflamed areola; in a short time, the pustules burst, pour out a viscid secretion like honey, which soon dries and forms thick, rough, yellow or greenish crusts. There are several varieties depending upon shape, extent, appearance, and part attacked.

What is the *treatment?* If vicarious of any other affection, it should be healed with great caution, and the condition of the internal organs watched. The treatment very much resembles eczema; in the inflammatory stage, antiphlogistic remedies, as cathartics, local or general bleeding, are demanded; also local remedies calculated to reduce inflammation, and particularly cleanliness, should be observed. In chronic cases, a tonic alterative may be necessary.

Favus.

Synonymes.—Tinea, Tinea Maligna, Porrigo, &c.

What are the *characteristics?* It is a contagious disease of the hair follicles of the skin, in which a peculiar, yellow substance surrounds the hair, and becomes elevated above the surface, forming dry, yellow, cup-like crusts, depressed in the centre, with an inverted edge, and a hair in the centre of each.

What is the *treatment?* It generally attacks those of a weak, debilitated, scrofulous constitution; or, if not naturally so, soon becomes depraved; the treatment, therefore, should be to invigorate the general system by fresh air, good diet, alteratives, tonics, and laxatives, when the case requires them. Cleanliness is very important, and will itself go far towards a cure; the crusts should be softened by emollient, alkaline, and anodyne applications; the hair should be cut short, and, when loose, removed; a great variety of local applications have been recommended.

ORDER 4.—EXANTHEMATA, OR RASHES.

What are the *characteristics* of this order? Inflammatory redness, usually superficial, disappears upon pressure, and commonly terminates in resolution, with or without exfoliation of the epidermis. There are six diseases belonging to this order, viz.: *Rubeola, Scarlatina, Erysipelas, Erythema, Roseola*, and *Urticaria.*

Roseola.

Synonymes.—Rose-rash, Rubeola Spuria, Rosalia.

What are the *characteristics?* Small patches of a rose color, numerous, superficial, somewhat resembling measles, but without the fever, cough, and injected conjunctiva.

What is the *treatment?* But little is necessary; mild laxatives, rest, low diet, &c., are sufficient for its cure.

Urticaria; Nettle-rash.

What are the *characteristics?* Non-contagious; patches of skin slightly elevated, hard, usually circular or sometimes elongated, varying in size from a split pea to an inch in diameter; mostly whiter than the skin, but sometimes a bright rose red, accompanied with itching and heat, with or without fever and general irritation.

What is the *treatment?* Remove the exciting cause; use mild and cooling laxatives, and light food.

Erythema.

Synonymes.— Tooth-rash, Intertrigo, Inflammatory Blush.

What are its *characteristics?* Non-contagious rash in patches of a red color, superficial, irregular as to size and extent, heat, itching, and usually with little or no fever. There are several varieties, depending upon slight changes of appearance, &c.

What is the *treatment?* Remove the cause, use a mild diet, antacids, laxatives, and bathing, which will generally remove the disease; for erythema of the nipples, see "Sore Nipples," under another head.

Order 5. — Papulæ.

What *characterizes* this order? Small, hard, resisting elevations of the skin, which contain no fluid, with more itching than in any other order of cutaneous diseases. There are two diseases of this order, viz.: *Lichen*, and *Prurigo*.

Lichen.

Synonymes.—Papulæ, Scabies Sicca, Scabies Agria.

What are its *characteristics?* Non-contagious; small, hard, solid pimples, usually acuminated and grouped, with severe itching. They terminate by resolution or superficial ulceration, and occur most frequently upon the extensor surfaces. There are three varieties, viz.: *L. strophulus*, *L. simplex*, and *L. agrius*.

What is the *treatment?* When occurring in the young and plethoric, the antiphlogistic treatment, as purgatives, bleeding, low diet, &c., is proper. In chronic cases in the aged and debilitated, mild laxatives, tonics, and a better diet, are more proper. Corrosive sublimate and tr. cantharides sometimes suit admirably; also, the bitter infusions aud mineral acids. The local applications should be properly adapted; when highly inflamed, emollients; and when chronic, more stimulating remedies are necessary.

Prurigo.

Synonymes.—Scabies Papuliformis, Pruritis, Old Man's Itch.

What are the *characteristics?* Non-contagious; distinct papules, usually of the same color as the skin, larger and less acuminated than lichen; and severe itching, which is intolerable. The patient by scratching takes off the top of the papule, and causes a drop of blood to ooze out, which by drying forms a little black scab, characteristic of this disease. There are three varieties; *P. Mitis*, *P. Formicans*, *P. Senilis.*

What is the *treatment?* Very similar to lichen; the diet should be regulated, and the digestive organs put in good order; violent exercise and exciting passions should be avoided; and the sulphur or other baths are almost indispensable.

ORDER 6. — SQUAMÆ.

What are the *characteristics* of this order? The formation of a scale, or scales, without being preceded by any of the other elementary forms of eruption; it is a diseased production of epidermis from inflammation, and not the result of a desiccated secretion. There are four diseases of this order, viz.: *Pityriasis, Lepra, Psoriasis*, and *Ichthyosis*.

Pityriasis.

What are the *characteristics?* Non-contagious; slightly inflamed patches of skin of variable extent, upon which are formed minute semi-transparent scales, or a whitish scurf, in large quantities. Its varieties are named from the color and part attacked.

What is the *treatment?* The general health should be attended to; mild antiphlogistics, as cathartics, &c.; alteratives and tonics are each proper, according to the condition of the system in the different stages.

Lepra; Leprosy.

What are the *characteristics?* Non-contagious; inflamed elevations of the skin, which soon produce on their summits thin, white, semi-transparent scales, that are reproduced speedily when removed.

What is the *treatment?* Antiphlogistics, with their activity proportioned to the severity of the inflammatory symptoms; bathing, alterants, &c. Arsenic, corrosive sublimate, iodine, sarsaparilla, mineral acids, sulphur vapor bath, and mercury, have all been used in this disease. Locally, the tar ointment, iodide of ammonia, iodide of sulphur, &c., may be proper. Whatever course is adopted should be persevered in.

Psoriasis.

Synonymes.—Scabies Sicca, Psora Leprosa, Dry Scalls, Dry Tetter, &c.

What are the *characteristics?* Non-contagious; slightly salient patches of irregular shape, elevated in the middle, and covered with the same kind of scaly eruption as exists in lepra, which it closely resembles; so that some authors describe them as the same disease There are several varieties, depending upon the shape, severity, and part attacked.

The *treatment* is similar to that of lepra.

Ichthyosis.

Synonymes.—*Fish Skin Disease, Porcupine Disease.*

What are the *characteristics?* A thickening of the epidermis into dry, hard, rough, and adherent scales, of a dirty, grayish color, like fish scales.

The *treatment* is not very satisfactory. Pitch internally has been advised, along with alkaline or sulphur vapor baths externally.

ORDER 7.—TUBERCULÆ.

What are the *characteristics* of this order? Small, hard, distinct tumors, as an elementary form of eruption. There have been mentioned six diseases as belonging to this order, viz.: *Elephantiasis* of the Greeks, and of the Arabs. *Frambœsia, Molluscum, Keloides*, and *Lupus*

Lupus.

What are the *characteristics?* An eruption of flattened tubercles usually occurring on the face, of a deep red color, of variable intensity, and tending to ulceration. There are three varieties, viz.: *L. Exedens, Non-exedens*, and *L. with Hypertrophy.*

What is the *general treatment?* Restore and preserve the general health by a mild diet, bathing, tonics, bitter infusions, mineral acids, hydriodate of potash, &c., properly adapted to the condition of the system. Locally, iodine, iodide of sulphur, solutions of arsenic, corrosive sublimate, nitrate of silver, &c., have been used.

ORDER 8.—MACULÆ.

What are the *characteristics* of this order? Permanent alterations of the skin, with an increase or deficiency of the natural pigment, and are rather physiological than pathological changes.

Purpura.

Synonymes.—*Hemorrhagia Petechialis Petechia.*

What are the *characteristics?* Small, dark, red, livid spots, beneath the cuticle, unaccompanied by pain, heat, or itching.

What is the *treatment?* It varies in different cases, depending upon the constitutional symptoms, and the general condition of the system. If plethoric, depletives; if there is a depressed condition, fresh air, tonics, nourishing diet, exercise, &c., should be adopted.

THE END.